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~~FM~~ 44-62

WAR DEPARTMENT ~~FIELD~~ MANUAL

SERVICE OF THE PIECE  
TWIN 40-MM GUN  
MOTOR CARRIAGE  
M19

FILE COPY

WAR DEPARTMENT • SEPTEMBER 1947

WAR DEPARTMENT FIELD MANUAL

F M 44-62

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SERVICE OF THE PIECE

TWIN 40-MM GUN  
MOTOR CARRIAGE  
M19



WAR DEPARTMENT • SEPTEMBER 1947

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WAR DEPARTMENT  
Washington 25, D. C., 5 September, 1947

FM 44-62, Service of the Piece, Twin 40-mm Gun Motor Carriage M19, is published for the information and guidance of all concerned.

[AG 300.7 (30 Jan 47)]

BY ORDER OF THE SECRETARY OF WAR:

DWIGHT D. EISENHOWER  
*Chief of Staff*

OFFICIAL:

EDWARD F. WITSELL  
*Major General*  
*The Adjutant General*

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AAF (5); AGF (15); T (5); Arm & Sv Bd (1), except 44 (5); Tech Sv (1), except 9 (5); Dep 9 (2); Gen & Sp Sv Sch (3), except 6, 44 (200); ROTC 4, 6, 44 (50); USMA (15); A (5), except ZI (25); CHQ (5); D (5); B 6, 44 (5); R 6 44 (2); T/O & E: 44-75 (5); 44-76 (1); 44-77 (25).

For explanation of distribution formula, see TM 38-405.

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# CHAPTER 1

## GENERAL

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**1. PURPOSE AND SCOPE.** This manual prescribes the knowledge and skill required to serve effectively the twin 40-mm gun motor carriage M19 (figs. 1 to 3, incl.). It is a guide for the battery commander, the section leader, and the squad leader in training their crews in the service of the piece of the weapon. It covers organization, duties of personnel, equipment, drill, and maintenance task tables. Detailed description of matériel and maintenance procedures, stowage of equipment, and methods of demolition to prevent enemy use, are contained in TM 9-757. Methods of employment are contained in FM 44-2.

### **2. CHARACTERISTICS AND DATA. a. Twin 40-mm gun motor carriage M-19.**

Angular rates power control, maximum:

Azimuth.....	40° per second
Elevation.....	25.4° per second

Armor:

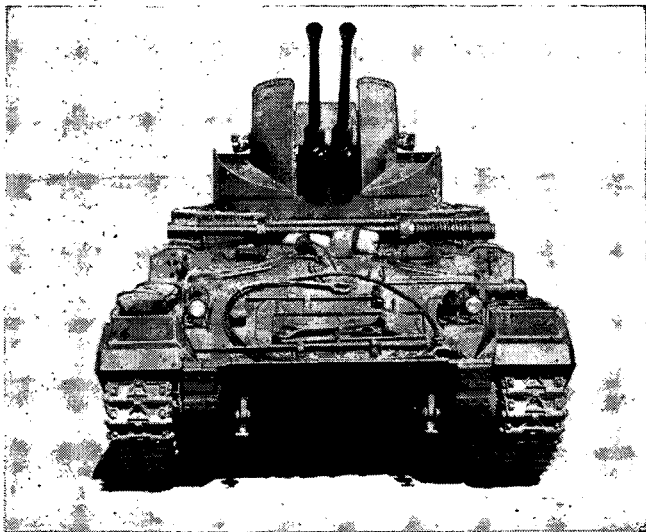
Hull front, sides, and rear.....	1/2 in.
Other.....	1/4 to 1/2 in.

Cruising range, depending on

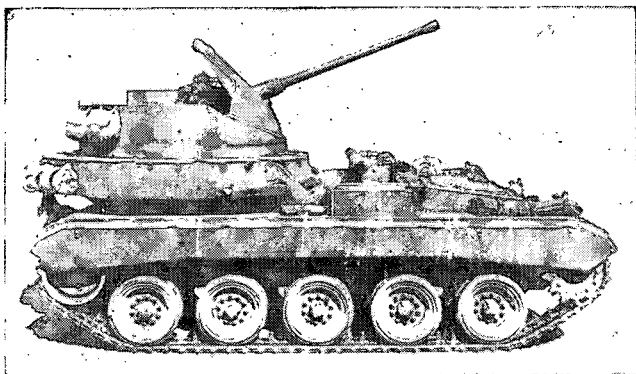
terrain .....	60 to 125 miles
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Depression, maximum.....5°

*Note. For military terms not defined herein, see TM 20-205.*



*Figure 1. Twin 40-mm gun motor carriage M19, front view.*



*Figure 2. Twin 40-mm gun motor carriage M19, side view.*

Distance between tracks.....80 in.  
 Elevation, maximum.....87°  
 Fording depth, maximum.....42 in.  
 Fuel tank capacity (two 55-gal-  
   lon tanks).....110 gal.  
 Grade, maximum (ascending or  
   descending).....60 percent  
 Ground clearance.....17¾ in.

Height:

  Gun trunnion..... 83 in.  
   Hull top..... 59 in.  
   Over-all.....119 in.

Length:

  Over-all.....228¾ in.  
   Vehicle and trailer.....347 in.

Obstacles, maximum:

  Ditch, width..... 9 ft.  
   Verticle height.....40 in.

Recoil of guns:

  Maximum.....8.95 in.  
   Normal (7.87 preferred) ....7.4 to 8.3 in. limit

Speed, maximum sustained.....30 mph.

Track width.....16 in.

Traverse.....360°

Turning radius, minimum.....40 ft.

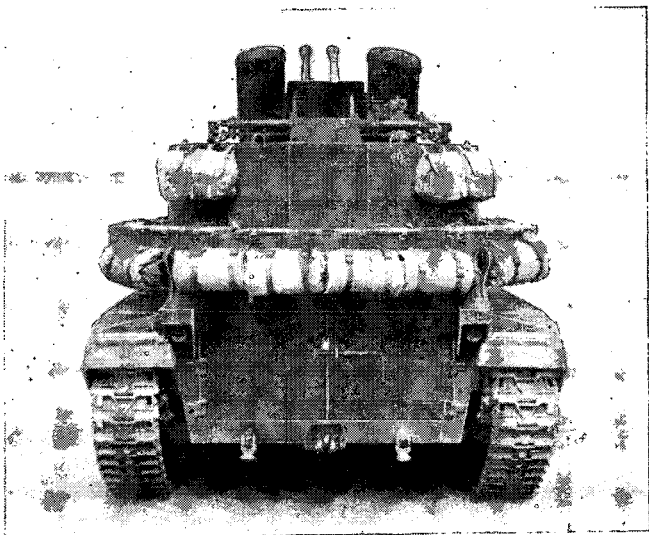
Weight of guns and carriage:

  Fighting.....39,000 lb.

  Shipping.....33,775 lb.

Width, over-all.....117⅞ in.





*Figure 3. Twin 40-mm gun motor carriage M19, rear view.*

**b. Ammunition trailer M28.**

Body type.....	Ammunition
Brakes.....	Hand parking only
Ground clearance.....	16½ in.
Height, to top of ammunition containers.....	55 in.

**Length:**

Over-all.....	142 in.
Trailer body.....	101 in.
Tire size.....	7.50 x 20

**Weight:**

Net.....	1,527 lb.
----------	-----------

With ammunition containers  
empty and camouflage  
net..... 2,352 lb.

With ammunition containers  
full and camouflage net...3,783 lb.

Width, over-all.....72 in.

### 3. REFERENCES.

- FM 5-20 Camouflage, Basic Principles.
- FM 21-6 List and Index of WD Publications.
- FM 21-7 List of War Department Films, Film Strips, and Recognition Film Slides.
- FM 21-8 Military Training Aids.
- FM 44-2 Employment of Antiaircraft Artillery Automatic Weapons.
- FM 44-11 Gunnery for Antiaircraft Artillery Automatic Weapons.
- FM 44-51 Fire Control, Antiaircraft Artillery Automatic Weapons.
- FM 44-57 Service of the Piece, Multiple Machine Gun Mounts.
- TM 9-252 40-mm AA Gun Matériel.
- TM 9-757 Twin 40-mm. Gun Motor Carriage M19.
- TM 11-454 The Radio Operator.
- TM 11-600 Radio Sets SCR-508-A, C, D, AM, CM, DM, SCR-528-A, C, D, AM, CM, DM; and AN/VRC-5; and SCR-538-(\*).
- TM 21-300 Driver Selection, Training, and Supervision, Wheeled Vehicles.

TM 21-306 Manual for the Full-Track Vehicle  
Driver.

AR 750-10 Range Regulations for Firing Am-  
munition for Training and Target  
Practice.

## CHAPTER 2

### ORGANIZATION

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#### Section I. GENERAL

**4. GENERAL.** The twin 40-mm gun motor carriage M19 is manned by an automatic weapons squad. One automatic weapons squad and one machine gun squad (FM 44-57) make up an automatic weapons section. A platoon is composed of a headquarters and four firing sections. (See fig. 4.) The self-propelled automatic weapons battery is composed of a headquarters and two platoons.

**5. AUTOMATIC WEAPONS SECTION.** The automatic weapons section is composed of an automatic weapons squad and a machine gun squad. The section is commanded by a sergeant, who rides with the automatic weapons squad.

**6. AUTOMATIC WEAPONS SQUAD.** The automatic weapons squad is composed of five men. The squad leader, a corporal, commands the squad. The individual members of the squad are listed below, and are referred to by numbers and abbreviations given at the left margin. (See fig. 5.)

SL Squad leader (lead setter).

- 1 Gun pointer.
- 2 Right cannoneer.
- 3 Left cannoneer.
- 4 Driver.

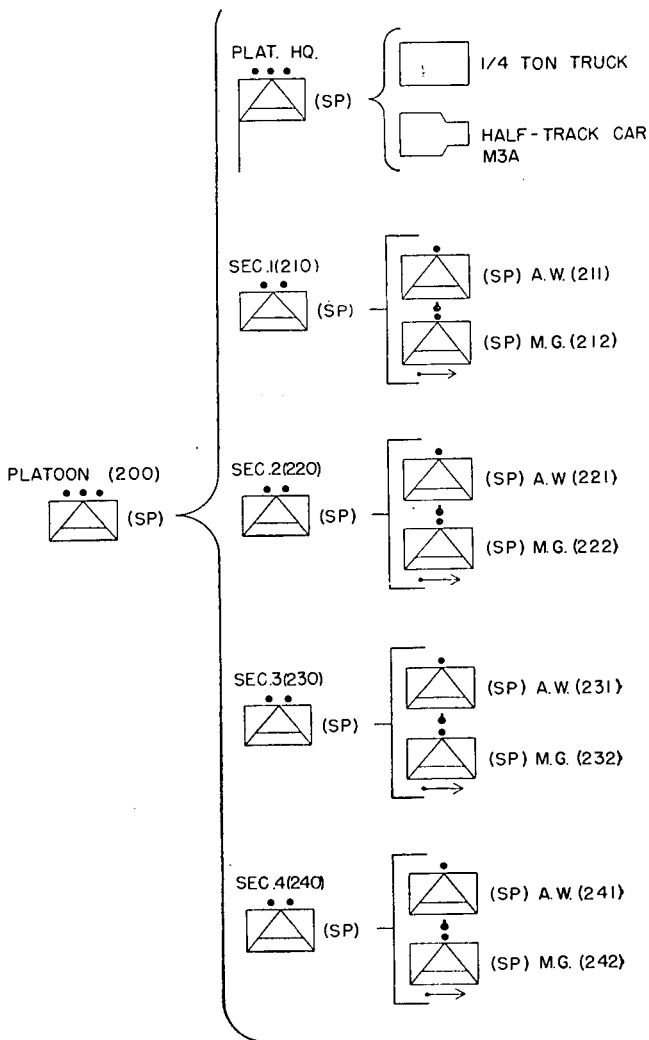
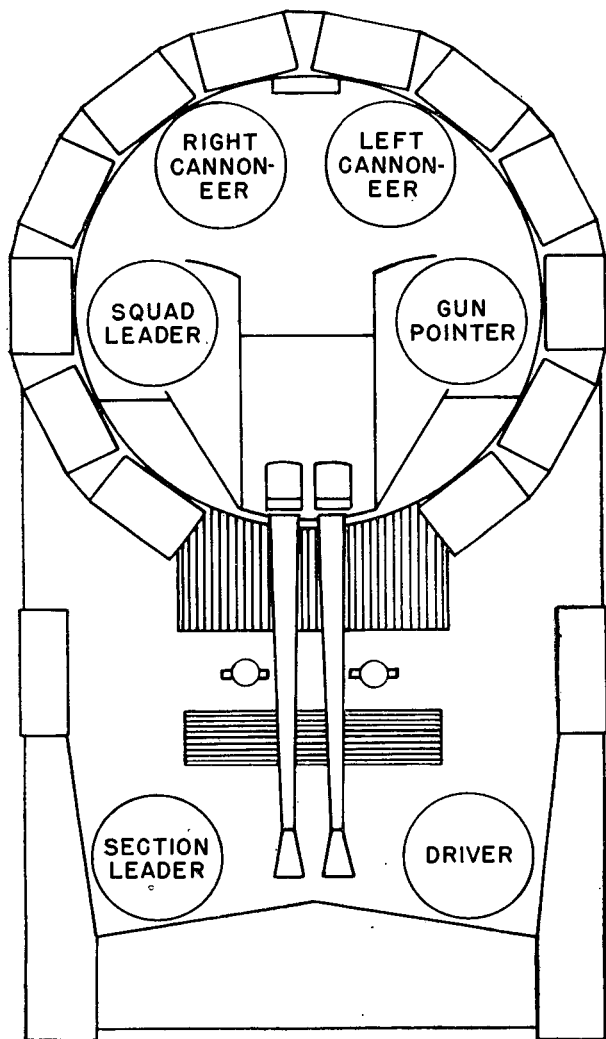


Figure 4. Organization of automatic weapons platoon.



*Figure 5. Position of squad mounted.*

**7. DESIGNATION.** To simplify the transmission of messages, a numerical designation for each squad in the battery is used. Each squad is designated by a three-digit number. The units figure designates the squad of the section, the tens figure designates the section of the platoon, and the hundreds figure designates the platoon. The number 232 refers to the second squad of the third section in the second platoon. The number 220 indicates the entire second section of the second platoon and number 200 indicates the entire second platoon. (See fig. 4.)

## **Section II. DUTIES OF PERSONNEL**

**8. SECTION LEADER.** The section leader (Sec. L) is responsible for the employment of the section and for the execution of its mission. He enforces correct instructions as to the status of alert in his section. He coordinates the occupation of positions and is responsible for carrying out instructions as to camouflage, field fortifications, sanitation, and the enforcement of camouflage and gas discipline. He initiates and maintains all necessary local security measures. He controls road and tactical movements of the section. The section leader, together with the platoon sergeant, plans the details of supplying his section with food, water, ammunition, and fuel. The assignment of personnel and development of skill in his section are the primary training responsibilities of the section leader. He is responsible for the submission of reports and local terrain maps of his positions as required. The section leader rides in the

assistant driver's compartment of the twin 40-mm gun motor carriage M19 and operates the radio. In case of emergency, he drives the vehicle by means of the dual controls.

**9. SQUAD LEADER. a.** The squad leader is in command of the weapon and crew. He is responsible for the training of the squad and for its effectiveness and teamwork in combat. He is responsible for replenishing food, water, ammunition, and fuel through his section leader. He operates the computing sight M13 and is responsible for the functioning and maintenance of the sighting system.

**b.** In the field he is responsible for—

- (1) Correct emplacement of the equipment.
- (2) Proper maintenance and adjustment of the equipment.
- (3) Functioning of the equipment during firing.
- (4) Fire control of the squad.

**c.** The squad leader insures observance of the following precautions:

- (1) *Do* be sure the outer extractor releasing lever is not operated when the gun is loaded.
- (2) *Do* be sure the guns are held down securely when a barrel is removed.
- (3) *Do* be sure the breech ring retaining pin is in the gun casing before removing a barrel.
- (4) *Do* be certain to remove the muzzle bore sight after orientation. The muzzle bore sight has a large red tag which should remain permanently affixed to make it conspicuous.



**10. GUN POINTER.** The gun pointer, a technician 5th grade, operates the drive controller, when at power control, to track the target. He fires the guns by means of the firing triggers on the drive control handles or the foot firing pedal. At manual control he operates the elevation hand operating crank to track the target vertically.

**11. RIGHT CANNONEER.** The right cannoneer mans the right 40-mm gun when at power control. He is responsible for supplying ammunition to the right gun and for proper functioning of the gun. When at manual control he operates the traversing hand operating crank to track the target in azimuth.

**12. LEFT CANNONEER.** The left cannoneer mans the left 40-mm gun. He is responsible for supplying ammunition to the left gun and for proper functioning of the gun.

**13. DRIVER.** The driver, a technician 5th grade, operates the vehicle. He is responsible for first echelon maintenance of the vehicle. He keeps the squad leader informed as to the status of fuel, oil, and water in the vehicle. When at manual control, he performs the duties of right cannoneer when so directed by the squad leader.

*Note. Each member of the crew should be trained to perform the duties of any other member so that in the event of casualties, the unit can continue to fight efficiently.*

## CHAPTER 3

### EQUIPMENT

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#### Section I. MOTOR CARRIAGE

**14. GENERAL.** The twin 40-mm gun motor carriage M19 is a lightly armored, full track laying vehicle of tank type construction. The vehicle has a driving compartment at the front, an engine compartment in the middle, and a twin 40-mm gun mount M4 and a stowage compartment at the rear. (See fig. 6.) The vehicle is driven by two 110-horsepower 346-cubic-inch V8 engines through two Hydramatic transmissions, a transfer unit with mechanically selected speed ranges, a controlled differential for steering and braking, two final drives, and the necessary connecting propeller shafts. Dual driving controls are provided with one set for the driver, and one for emergency operation of the vehicle by the section leader.

**15. COMMUNICATION.** A radio set AN/VRC-5 with interphone is installed in the section leader's compartment. The radio receiver is mounted in front of the section leader's seat; the transmitter is located on the left side. For quick operation of the transmitter and receiver, 10 preset push buttons are provided. On the receiver any of 80 channels may be used by manual control. The trans-

mitter contains 80 crystals, any 10 of which may be inserted. The interphone system has 4 stations and provides for communication between the section leader, squad leader, driver, and gun pointer. Other means of communication carried are identification panels and flash lights.

**16. CONTROLS AND INSTRUMENTS. a. Master battery switches.** Two master battery switches are located in the driver's compartment. (See fig. 7.) It is advisable to have both switches on for operation of the radio, interphone system, or power operation of the gun mount, in order to prevent excessive drain to one set of batteries.

**b. Ignition switches.** Two ignition switches, one for the left and one for the right engine, are located on the instrument panel. (See fig. 8.) When they are turned ON, warning lights are illuminated. The emergency ignition switch, located on the hull roof slightly to the rear of the driver, is wired in series and must be on at all times; otherwise, the ignition switches on the instrument panel will not work. The emergency ignition switch is provided so that in an emergency both engines can be turned off by either the driver or section leader.

**c. Fuel tank controls.** Two fuel valve control handles (fig. 9) control the fuel shut-off valve and the power feed to the fuel pumps. When the levers are down, the fuel valves are open and the current to the fuel pumps is ON. The two levers can be turned on or off independently. At least one of the ignition switches must be on to complete the feed circuit to the fuel pumps.

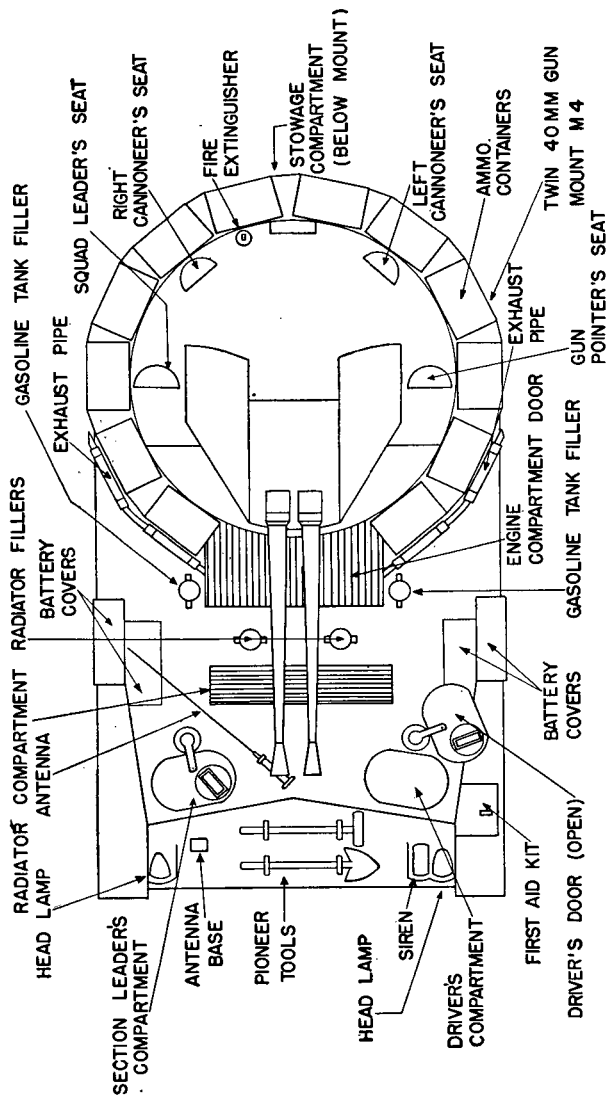
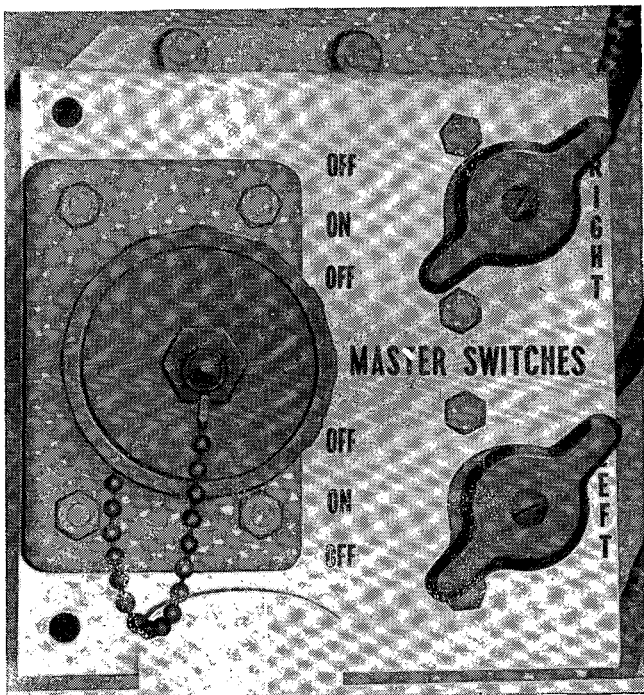
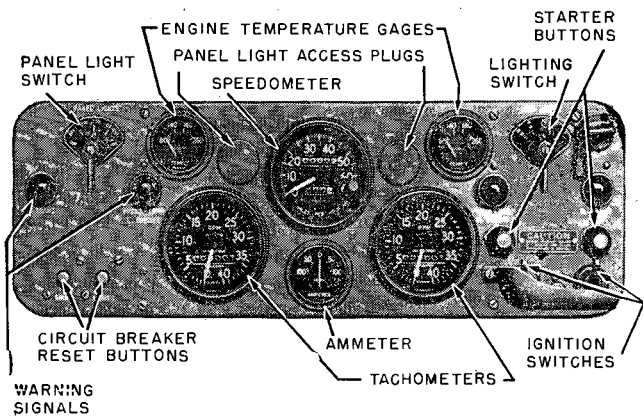


Figure 6. Location of assemblies and component parts of twin 40-mm gun motor carriage M19.

**d. Starter switches.** Two starter switches are located on the instrument panel. (See fig. 8.) Both engines are started at the same time (except in extremely cold weather) by pressing both starter switches.



*Figure 7. Master battery switches.*



*Figure 8. Instrument panel.*

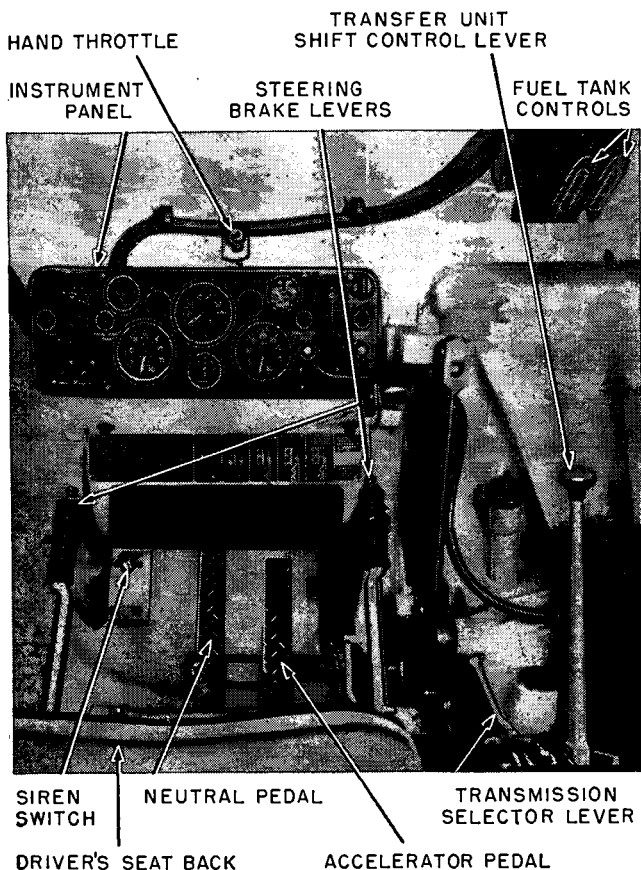
**e. Lighting switches.** The switch for blackout and driving lights is located on the instrument panel. (See fig. 8.) The switch provides for blackout marker lights, blackout driving lights, day-time stop light, or headlights. An instrument panel light switch is also located on the instrument panel.

**f. Siren switch.** The siren switch is located on the lower hull front plate and is operated by a button above the driver's left foot. (See fig. 9.)

**g. Accelerator.** Individual foot accelerator pedals are provided for the driver and section leader. Each accelerator pedal controls both engines. (See fig. 9.) The accelerator pedal on the section leader's side should be disengaged when not in use. A hand throttle is also provided for the driver. The hand throttle is self-locking in any position, and is released by means of a spring button in the center of the control knob.

**h. Choke.** An automatic choke mechanism is located on each carburetor to provide the correct fuel mixture for starting the engines. Fast idle with cold engines is obtained by using the hand throttle.

**i. Steering and braking control levers.** Steering and braking control levers are provided for both the driver and section leader. (See fig. 9.) To steer the vehicle, pull the lever on the side toward which it is desired to turn. Either set of levers may be swung forward when not in use. Pulling back simultaneously on both steering and braking levers slows down or stops the vehicle, depending on the effort applied. Parking brake controls are provided on the driver's steering and braking levers. These levers may be locked in the applied position by depressing the small knob in the center of the steering lever. Parking brakes are released by pulling back on the steering and braking levers.



*Figure 9. Driver's compartment.*

**j. Shifting controls.** Two shifting controls are used: a range selector lever for the transmissions, and a manual shift control lever for the transfer unit. (See fig. 10.)



(1) The transmission selector control lever has three positions: NEUTRAL, DRIVE, and LOW. NEUTRAL prevents the units from transmitting the engine power; DRIVE permits shifting through all four speeds; and LOW limits the transmission to first and second speeds in order to utilize the power of engines for braking or low speed operation over very rough terrain.

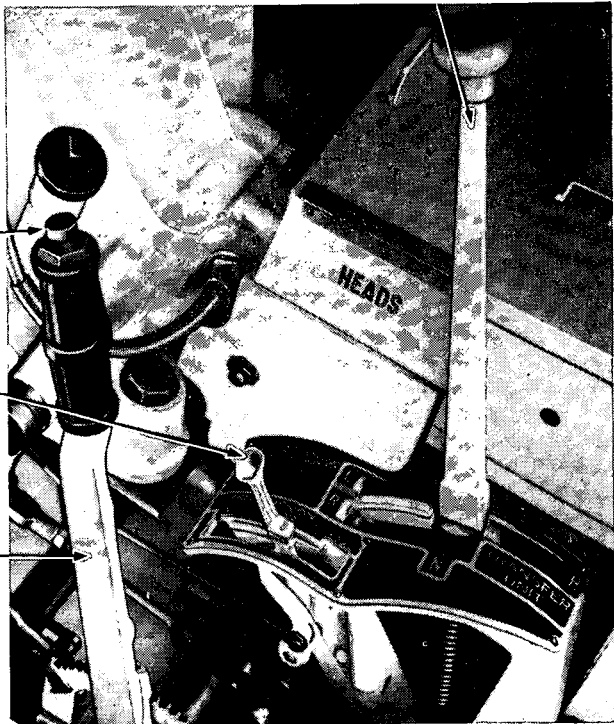
(2) The transfer unit shift control lever had three positions besides NEUTRAL. Moving the lever to the right and rearward provides HIGH range; moving the lever forward provides LOW range; and moving the lever to the left and forward provides REVERSE.

**k. Neutral pedal.** In order to shift the transfer unit, it is necessary to have the transmissions in NEUTRAL while the shift is being made. The transmissions can be shifted in NEUTRAL either by moving the transmission selector control lever to NEUTRAL or by depressing the NEUTRAL pedal. (See fig. 9.)

**l. Seat adjustment.** Both the driver's and section leader's seats can be adjusted 4 inches forward or backward or 10 inches vertically. To move forward or backward, push in the horizontal adjustment release lever on the left rear side of the seat and slide the seat as desired. The seat elevating lever for vertical adjustment is on the right front side of the seat. To raise or lower the seat, raise the control lever and apply or take weight off the seat. The two gunners' seats are similar to the drivers' seats, having the same adjustments. The loaders' seats are not adjustable.

LOCKING PAWL  
KNOB

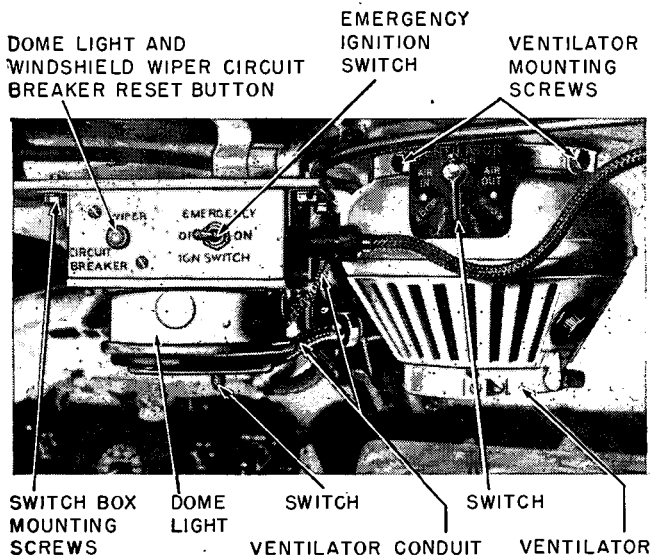
TRANSFER UNIT SHIFT CONTROL LEVER



R. H. STEERING  
BRAKE LEVER

TRANSMISSION  
SELECTOR LEVER

*Figure 10. Shifting controls.*



*Figure 11. Ventilator controls and emergency ignition switch.*

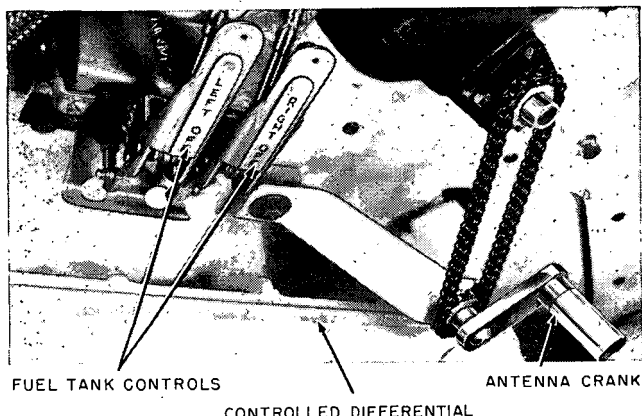
**m. Ventilator controls.** A two-way ventilator is located on the hull roof between the driver and assistant driver and is operated by a four-position switch. (See fig. 11.) To draw air into the driving compartment from the outside, the switch is turned to the left (to AIR-IN position) and to the FAST or SLOW position, as desired. To take foul air out of the driving compartment, the switch is turned to the right (to AIR-OUT position) and to the FAST or SLOW position, as desired. A circuit breaker reset button is located on the forward side of the unit and acts as a fuse in the circuit. A shut-off valve is provided in each air

outlet elbow which will completely block the movement of air in or out of the vehicle at any time.

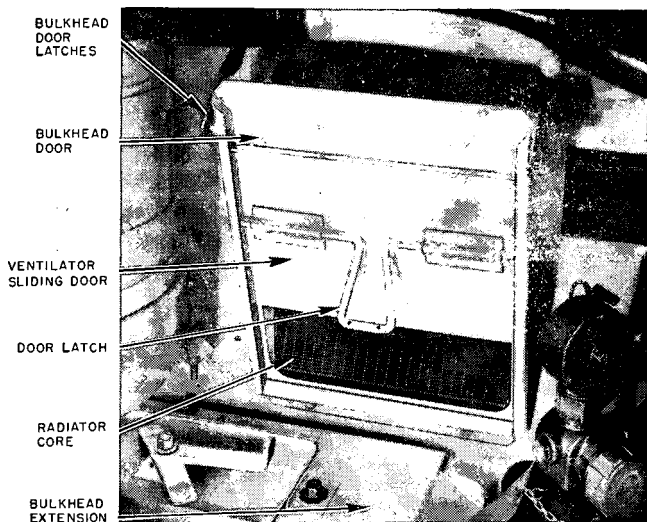
**n. Ventilating doors in bulkhead.** Additional ventilation for the driving compartment can be secured by opening the ventilating doors in the bulkhead. (See fig. 13.) This permits the engine fans to draw smoke-filled air from the compartment.

**o. Antenna crank.** The radio antenna can be raised, for best reception, or lowered, when passing through brush or trees or when firing the guns, by turning the antenna crank at the center of the upper front hull plate. (See fig. 12.)

**17. INSTRUMENTS. a. Ammeter.** An ammeter for the electrical system is located in the lower center of the instrument panel (fig. 8) and is connected so as to indicate the amount of charge or discharge in the main battery circuit.



*Figure 12. Antenna crank and fuel tank controls.*



*Figure 13. Bulkhead doors.*

**b. Engine temperature gages.** Two gages for indicating engine temperatures are located in the upper left and right center of the instrument panel. (See fig. 8.) These gages are connected electrically to the thermo units on the engines.

**c. Oil pressure warning signals.** Warning signals for oil pressure (and engine water temperature) are located one on each side of the instrument panel. (See fig. 8.) There is no oil pressure gage. A red signal lights if engine oil pressure drops below 12 pounds or if engine water temperature increases above 240° F. There is also a warning signal for low transmission oil pressure. Do not drive vehicle if any of these signals light

while the engines are running or while the vehicle is in operation.

**d. Speedometer.** The speedometer, located in the upper center of the instrument panel, indicates the speed of the vehicle as well as the mileage traveled.

**e. Tachometers.** There are two tachometers, one for each engine, located to the left and right center of the instrument panel. These instruments are geared to the distributor drive shafts through flexible cables. They indicate the speed of each engine and the total revolutions each engine has been operated. Speed is indicated in hundreds; that is, 10 indicates 1,000 revolutions per minute, and 25 indicates 2,500 revolutions per minute. Total revolutions are indicated in thousands.

## **18. INSTRUCTIONS FOR ENGINE OPERATION.**

The instructions which follow are those needed for normal operation of the vehicle.

**a. New vehicle run-in test.** Before a new or re-conditioned vehicle is placed in service, be sure that the new vehicle run-in test has been performed.

**b. Before-operation service.** Perform the services in paragraph 79 before attempting to start the engines. Start and warm up engines and complete the before-operation services. **Caution:** *Only gasoline with an octane rating of 80 or above can be safely used in this vehicle. Normally, the engines will not detonate (knock); if they do, it indicates either that the gasoline is of incorrect grade or that the ignition timing is incorrect. Check grade of fuel or readjust ignition timing.*

**c. Starting.** Under normal conditions, engines should be started according to the following procedure:

(1) Set the brakes.

(2) Place the transmission selector control lever in NEUTRAL and place transfer unit shift lever in the range in which the vehicles is to be driven.

(3) Turn ON master battery switches.

(4) Pull the fuel valve control handles down for the right and left tank.

(5) Turn ON emergency ignition switch.

(6) Turn ON ignition switches for both engines. (Engine and transmission oil pressure warning lights should go on.)

(7) Depress the accelerator pedal one-fourth to one-half of full travel.

*Note. Do not pump accelerator.*

(8) Press starter switch for each engine simultaneously until the engines fire.

*Note. Both engines should be started at the same time except at subzero temperatures.*

(9) After engines have started, pull hand throttle out to set engine idling speed at about 625 rpm. This prevents stalling during warming period. **Caution:** *It is important to turn electric gasoline pumps on before attempting to start engines and equally important to turn them off when the engines are stopped. Do not allow pumps to operate in a dry tank.*

**d. Engine check.** (1) Oil pressure warning lights should go OFF several seconds after the engines start. If they do not go OFF, turn engines OFF and investigate.

(2) Observe the ammeter. If the ammeter does not indicate plus with engines idling, speed up the engines by momentarily depressing the accelerator pedal. If the ammeter needle does not move to the plus side, look for slipping generator belts or broken connections.

(3) The temperature gages should indicate between  $160^{\circ}$  and  $210^{\circ}$  after the engines are warmed up. If warning light goes on indicating engine water temperature in excess of  $240^{\circ}$ , stop the engine and investigate for loss of coolant or plugged air intakes.

(4) Check for loose parts.

(5) Check for unusual noises in each power train and engine.

**e. Flooded engines.** A common cause of engines not starting in mild or warm weather is a flooded condition in the carburetor or intake manifolds. When flooding occurs, fully depress the accelerator pedal and then crank the engine. Do not pump the accelerator. When only one engine is flooded, turn the ignition of the other one off to prevent racing. When the flooded engine is started the other one can be restarted.

**f. Cold weather starting and warm-up.** Cold weather starting is the same as normal starting except that the engines are started one at a time. One engine can be started by means of the other to conserve battery current. After the engines are started, they are run at 800 to 900 rpm for 5 minutes with the transmission selector control lever in NEUTRAL. The transmission selector control lever is then moved to DR and the engines idled for several minutes more to warm the oil in



the transmissions. The vehicle should not be driven over 5 mph for at least 10 minutes after starting.

**g. Starting one engine with the other.** Make sure the running engine is turning freely and the transfer unit shifter control lever is in NEUTRAL. The transmission selector control lever is moved to DR. The ignition switch of the second engine is turned ON. The rotation of the operating engine will then be carried through the transfer unit gears to crank the other engine.

*Caution: Inspect "dead engine," to be sure it turns over freely, before attempting to start it by the use of the other engine.*

**19. DRIVING INSTRUCTIONS. a. Normal shift control.** For driving on roads or smooth, level terrain, the transfer unit shift control lever is moved to the H position and the transmission selector control lever is placed in the DR position. The transmission selector control lever must be moved to the left before it can be moved out of NEUTRAL. The transmissions are now in gear but to start the vehicle moving, the parking brake must be released and the accelerator pedal depressed. With this arrangement of the controls, the vehicle will start out in first gear and the transmissions will automatically shift up into second, third, and fourth gears as the vehicle speed increases and the engine load is reduced. As the vehicle loses speed the transmission will shift down automatically to a lower gear.

**b. Steering.** Pull back on the right-hand steering and braking control lever to make a right

turn, or on the left-hand lever for a left turn. The lever being used should be applied firmly and then released fully. This action is repeated if necessary. The lever must *not* be held in a slightly applied position for long periods of time. *It is important that the steering and braking control levers be held far enough forward to insure complete release of the bands at all times, except when steering or stopping; otherwise the brake lining wear will be excessive.*

**Caution:** *The driver must exercise caution, especially on curves, when driving on wet hard-surface roads as the steel tracks have a tendency to skid.*

**c. Stopping.** To stop the vehicle, release the accelerator and pull back on both steering and braking control levers at the same time. Both levers must be pulled back and engaged with heavy pressure and then released fully. If the stop is made from relatively high speed, intermittent heavy pressure is used. *Do not use the neutral pedal as a clutch when starting.*

**d. Reverse.** To operate the vehicle in reverse, first stop all forward movement. Depress the neutral pedal to put the transmission in NEUTRAL. Move the transfer unit shift control lever into REVERSE. Release the neutral pedal. Four speeds in reverse are automatically selected by the transmissions. Do not allow the engines to exceed 3,500 rpm when backing the vehicle.

*Note. Depressing the neutral pedal puts both transmissions in neutral by means of the same linkage as the selector lever but leaves the driver's right hand free to shift the transfer unit. Releasing the pedal puts the transmis-*

sion back in the range for which the selector lever is set. Neutral pedal should be used only when throttles are closed.

**e. Ascending hills.** When ascending moderate hills from a running start, the power train automatically shifts the gears down as the vehicle loses speed. Before ascending steep hills from a stop, the transfer unit is shifted to "L" before starting. Always press the neutral pedal or move the transmission selector control lever to NEUTRAL before moving the transfer unit shift control lever.

**f. Descending hills.** In descending moderately steep hills, the transfer unit shift control lever and the transmission selector control lever are shifted to L and LO, respectively, before starting. In descending very steep hills the vehicle is slowed until the transmissions shift to second gear and the brakes are used to keep engine speeds below 3,500 rpm.

**Caution:** *Transfer unit shifts from HIGH to LOW must be made at speeds below 10 miles per hour. The NEUTRAL pedal must always be depressed when making the shifts.*

**g. Difficult terrain.** In traveling through mud, sand, or over rough terrain, the transfer unit shift control lever is shifted to L. If the engines labor under these conditions, the transmission selector control lever is shifted to LO.

**h. One engine operation.** If one engine or transmission fails and repairs cannot be made, the dead engine is disconnected at the transfer unit by means of the transfer unit input gear shifter clutch. (See TM 9-757.) The transfer unit

shift control lever is kept in L when driving with only one engine.

**20. STOPPING ENGINES.** To stop the engines, first idle them at approximately 425 rpm for 4 minutes. Then turn off the ignition switches, the emergency ignition switch, and fuel pumps switch, and open the master battery switches. If engines are extremely hot, run at 2,000 revolutions per minute for a few minutes, to cool down before reducing speed to normal idle. Finally, open master battery switch. *Caution: Always turn off ignition switches before opening master battery switches. Never operate engines with master switches off.*

**21. TOWING. a. Towing shackles.** Two towing shackles are mounted on the front and two on the rear of the vehicles.

**b. Towing to start vehicle.** The engines can be started in an emergency by towing the vehicle, provided the following procedure is observed after checking to make sure the engines turn freely.

(1) Release brakes.

(2) Place transmission selector lever in NEUTRAL and transfer unit shift lever in LOW.

(3) When speed reaches approximately 4 miles per hour, turn on both ignition switches and one fuel pump switch, and move transmission selector lever to DRIVE.

(4) Continue towing until engines fire.

**c. Towing disabled vehicle.** When towing a disabled vehicle, several precautions must be taken:

(1) Tow the vehicle with the transfer unit in NEUTRAL, if possible. If transfer unit is damaged or disabled, disconnect the propeller shaft at the controlled differential pinion shaft yoke.

(2) If controlled differential is disabled, disconnect the two short propeller shafts at the final drive yokes.

(3) If final drive units are disabled, break tracks, and tow vehicle on track suspension wheels. *Caution: Tow bar must be used under these circumstances.*

**d. Towing procedures.** In towing a vehicle, changes in direction must be made by a series of slight turns so that the vehicle being towed is, as nearly as possible, directly behind the one doing the towing. This prevents the cable from contacting the track, which might damage both the cable and track blocks. If no operator is available to steer the disabled vehicle, or if it is being towed with the tracks removed, the cable should be attached by the "short hitch," in which it is threaded through both eyes of the vehicle to be towed, and then crossed and passed through both shackles of the towed vehicle.

## **Section II. TWIN 40-MM GUN MOUNT M4**

**22. GENERAL.** The twin 40-mm gun mount M4 is an armored mount which can be operated manually or by power tracking. It is mounted on a large continuous roller bearing and is on the rear half of the motor carriage. (See figs. 14 to 16.)

**23. ASSEMBLIES.** **a.** The twin 40-mm gun mount M4 consists of the following assemblies: top carriage including cartridge case chutes, equilibrators, elevating and traversing locks, elevating rack, elevating and traversing mechanisms, firing mechanism, mount for drive controller T24, platform assembly, squad leader's, gun pointer's, and cannoneers' seats; and the shield assembly. The mount also acts as a support for the components of the local control system M16.

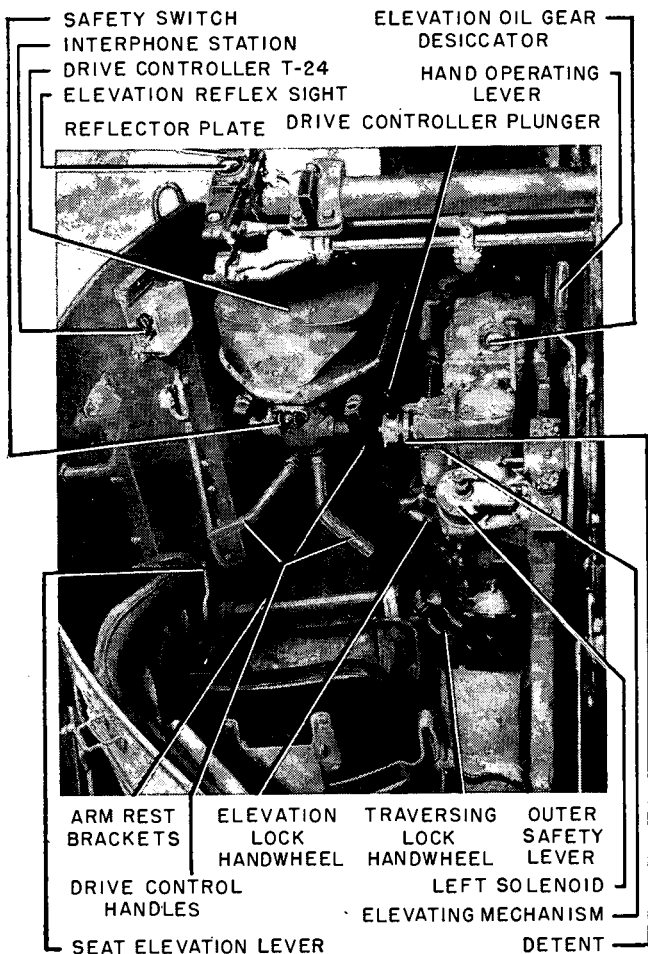
**b.** The top carriage acts as a support for the guns, equilibrators, azimuth and elevation switches, and the firing mechanism including the solenoid mounting brackets.

**c.** Two cartridge case chutes are provided to deflect the expended cartridge cases out of the mount.

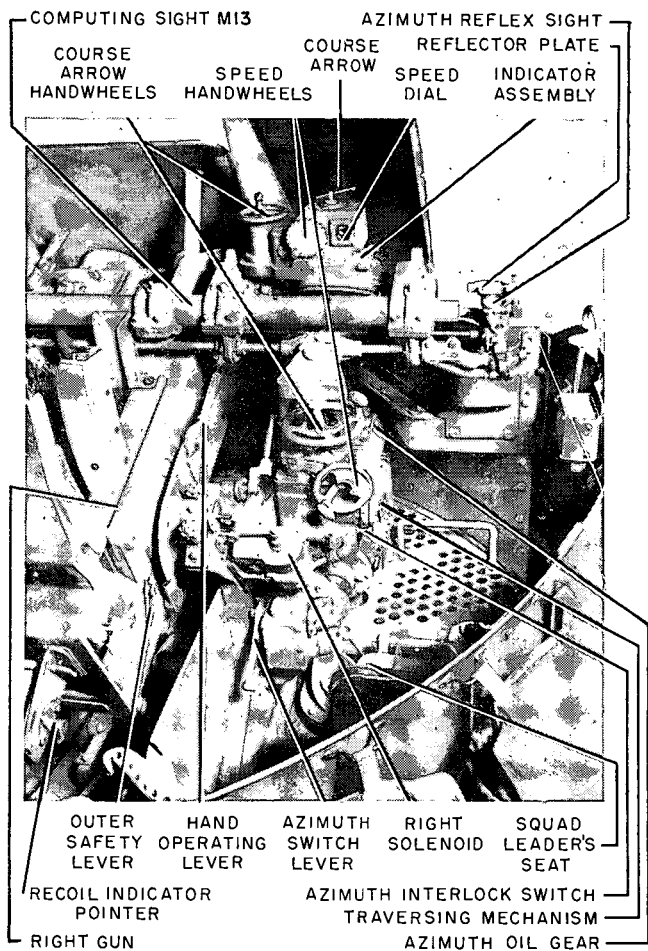
**d.** The mount is equipped with elevating and traversing locks to prevent motion of the guns and mount during travel.

**e.** The elevating mechanism is on the left side of the mount and the traversing mechanism is on the right. Two interlock switches, one on each side, prevent operation of the oil gears when the hand operating cranks are engaged. A detent on the elevating and traversing mechanism prevents the hand operating cranks from rotating due to friction when the oil gears are in operation and when the hand cranks are disengaged.

**f.** The firing mechanism consists of an electrical firing system and a foot firing pedal with a mechanical linkage leading to the firing plungers on each gun trunnion. (See par. 27.)

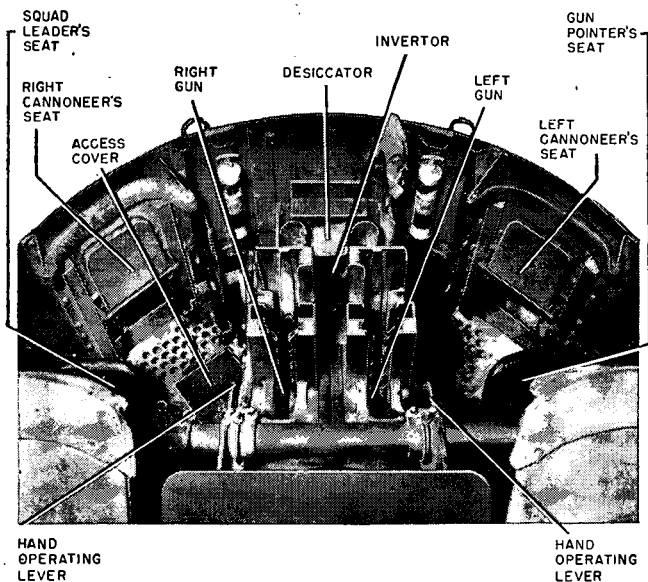


*Figure 14. Left side of twin 40-mm gun mount M4.*



*Figure 15. Right side of twin 40-mm gun mount M4.*





*Figure 16. Rear of twin 40-mm gun mount M4.*

**g.** The mount for the drive controller T24 is a bracket attached to the left forward segment of the shield assembly in front of the gun pointer's seat. It is designed so that the drive controller may be raised for power operation or lowered, to be out of the way, for manual operation.

**h.** The shield assembly surrounds the entire turret. Various brackets and containers are attached to hold small arms, bed rolls, field bags, a decontaminator, small arms ammunition, and other small items of equipment.

### **Section III. LOCAL CONTROL SYSTEM M16**

**24. GENERAL.** The local control system M16 is used when tracking by power control. Electric power is provided by storage batteries in the vehicle. Components of the local control system M16 are the drive controller T24, oil gears M6, and wiring set M10. The system provides a simple method by which one operator can control the guns laterally and vertically, track the target, and fire both guns simultaneously.

**25. DRIVE CONTROLLER.** For power controlled tracking, the movement of the guns, both laterally and vertically, is controlled by drive control handles on the drive controller T24. (See fig. 14.) The drive control handles, acting through a nonlinear mechanism, adjust the speed of movement laterally and vertically. A given position of the handles establishes a corresponding constant movement of the mount. The relationships between the mount speed and the drive control handle displacement is curvilinear. A small increment of drive control handle movement produces a greater change in mount speed at high mount speed than an equal increment of drive control handle movement produces at a low mount speed. The drive control handles are returned to the zero position both laterally and vertically by centering springs. Trigger switches in the drive control handles are used for firing both guns electrically. Smoother tracking is made possible by the use of the arm rest bracket attached at the bottom of the handle-bar control. To provide a dry atmosphere within

the drive controller a silica gel desiccator is utilized. The silica gel of the desiccator can be viewed through the window in the side. As the silica gel (indicator type) absorbs moisture, it gradually changes color from dark blue, to light purple, to dark pink, and then finally to light pink. *When the color is between light purple and dark pink, the desiccator should be replaced or the silica gel reactivated.*

**26. OIL GEARS.** Oil gears M6 are provided to drive the mount in azimuth and elevation. Hydraulic elevation limit stops on the oil gears permit the guns to be power operated from  $-4\frac{1}{2}^{\circ}$  to  $86\frac{1}{2}^{\circ}$ . Mechanical stops are set at approximately  $-5^{\circ}$  and  $87^{\circ}$ .

**27. WIRING SYSTEM M10.** a. The wiring system M10 consists of those parts of the local control system M16 not incorporated in the oil gears M6 and drive controlled T24.

b. A gun junction box in the front end of the mount receives the cables from the contact ring and other electrical components and distributes data and power through cables to the various units of the local control system.

c. An inverter (fig. 16) converts the 24-volt direct current from the vehicle storage battery to 115-volt, 60-cycle, alternating current for use to excite the synchro data transmission system and drive the small constant speed motor in the drive controller.

d. Wiring for the interphone system is provided to permit intercommunication between the

driver, the squad leader, gun pointer, and section leader. That portion of the wiring in the gun mount, including the cables connected thereto, is a part of the wiring set M10.

**e.** Two switch levers, one for azimuth and one for elevation, are located on the left side of the hand operating mechanisms for azimuth and elevation, respectively. (See figs. 14 and 15.) To close the switches, the switch levers must be in the down position. Both levers must be depressed for the local control system to operate. It is also necessary for the toothed clutches of the hand operating mechanisms to be disengaged so that the handwheel interlock switches will be closed. The four above-mentioned switches are connected in series to prevent personal injury to the crew.

**f.** The two hand operating crank interlock switches, one for azimuth and one for elevation, are located below the toothed clutches of the azimuth and elevation hand operating mechanisms, respectively. To close the switches, disengage the toothed clutches.

**g.** A safety switch, located on the drive controller, controls the electrical circuit for firing the guns by means of solenoids. (See fig. 14.) The switch must be turned to the ON position in order to activate the circuit.

**h.** Both guns are fired electrically by pressing either trigger switch in the drive control handles. (See fig. 14.) Closing the trigger switches energizes the two firing solenoids (figs. 14 and 15) which pull plungers upward to operate the mechanical firing mechanism. The solenoids should

be adjusted so that there is  $\frac{1}{2}$  to  $\frac{5}{8}$  inch free travel between the firing lever and the firing plunger. This may be accomplished by means of the adjusting screw mounted on the top of each solenoid. This adjustment is important as it prevents the solenoids from operating under a preloaded condition, thus conserving both solenoids and batteries.

***Caution:** The solenoids should not be kept energized during practice tracking.*

i. Master battery switches are provided in the driver's compartment of the vehicle. (See par. 16.) These switches control all power in the vehicle including the engines, oil gears, wiring set, and all other electrical components. They must be ON in order to operate the local control system.

## **28. MOUNT OPERATING INSTRUCTIONS. a.**

**Preparation for operation.** To prepare the weapon for operation, remove the muzzle covers from the flash hiders, the automatic loader hood from the automatic loaders, and the automatic loader shields from the openings in the rear breech casing covers. Rotate the azimuth and elevation traveling lock handwheels counterclockwise sufficiently to free the guns and mount. Rotate the antenna mast crank to place the antenna out of the field of fire.

**b. Power operation.** Turn ON the two master battery switches, the emergency ignition switch, and the two ignition switches. Press the starter switches to start the engines. Adjust the hand throttle so that the ammeter reads the maximum

output of the generators (approximately 50 amperes at 1,500 rpm). Remove the traversing and elevating hand operating cranks and disengage the toothed clutches. Turn the plunger of the drive controller so that it is retracted from the slide, and raise the drive controller to the operating position. Reengage the plunger with the slide. Throw the motor switch (on the under side of the drive controller) to the ON position. Depress the azimuth and elevation switch levers. To traverse or elevate the guns, rotate the drive control handles in the direction desired. To fire the guns, throw the safety switch (between the handle grips) to ON position, place the outer safety levers at SINGLE or AUTO FIRE, and squeeze the trigger switches or depress the foot firing pedal.

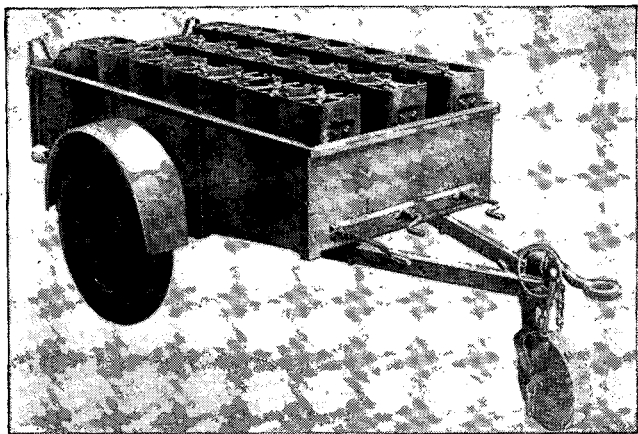
**c. Manual control.** Turn OFF the safety switch. Throw the drive controller motor switch to the OFF position. Raise the azimuth and elevation switch levers. Turn the plunger of the drive controller so that it is retracted from the slide, and lower the drive controller to the traveling position. Reengage the plunger with the slide. Attach the traversing and elevating hand operating cranks and push the clutch in until the gears mesh. Elevate or traverse the guns as desired by means of the hand operating cranks. To fire the guns, place the outer safety levers at SINGLE or AUTO FIRE and depress the foot firing pedal. It is not necessary to have the engines running during manual control; however, the master battery switches should be ON in order that the radio and interphone can be operated.

## **Section IV. COMPUTING SIGHT M13**

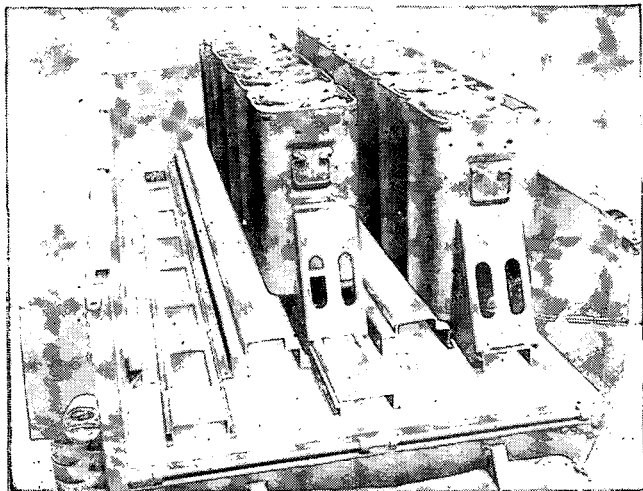
**29. GENERAL.** The computing sight M13 is an on-carriage course and speed type computing sight, designed for use with the twin 40-mm gun mount M4. (See figs. 14 and 15.) It is capable of computing for target speeds up to 500 mph. The sight is of rugged construction and little maintenance is required by the using personnel. All bearings in the sight are permanently lubricated and should not be disassembled or greased by using personnel. Two reflex sights, one on each side, make possible quick pick-up and accurate tracking of the target. The reflex sights normally are daylight illuminated; however, artificial illumination is provided for night use. Dual sets of controls are provided for adjusting the course arrow and speed setting. The lower set of controls is used when the mount is being operated at power control. The upper set is used during manual operation. The sight is similar to the computing sight M7 and is operated on the same fire control principles. (See FM 44-51.) Speed ring sights are provided for use in the event of mechanical failure of the computing sight.

## **Section V. AMMUNITION TRAILER M28**

**30. GENERAL.** An ammunition trailer M28 is provided with each twin 40-mm gun motor carriage M19 for hauling ammunition and other supplies. (See figs. 17 and 18.) It is the standard two-wheel 1-ton cargo trailer, modified to provide clamps to hold twenty 16-round ammunition chests M14 securely on the floor of the trailer.



*Figure 17. Ammunition trailer M28.*



*Figure 18. Ammunition trailer M28.*



Cranks which control the clamps are located at the front of the trailer. The trailer is towed behind the twin 40-mm gun motor carriage M19. During forward movement of the vehicle, the trailer follows automatically. When backing the vehicle with the trailer attached, pressure exerted on the right steering lever causes the front of the trailer to turn to the right; pressure on the left steering lever causes the front of the trailer to turn to the left. A canvas cover is supplied and should always be used when the trailer is being towed as the tracks of the carriage deflect a considerable amount of dust or mud rearward when in motion. **Caution:** *Care must be exercised to prevent buckling of the trailer and damage to the coupling.*

## CHAPTER 4

### DRILL

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#### Section I. PRELIMINARY COMMANDS AND FORMATIONS

**31. GENERAL. a.** The following drill is an analysis of jobs that must be performed by the members of the automatic weapons squad. Certain jobs within the squad are more complex than others. By close observation during preliminary training in drill, individuals are selected and assigned to the job most suitable to their aptitudes. The squad is then drilled as a team to obtain precision. Each member of the squad should be trained in the duties of other members of the crew. Battery officers are personally responsible for the supervision and coaching of the squad leaders in the conduct of drill.

**b.** The following general instructions apply to all drills:

(1) The drill prescribed herein will be adhered to strictly.

(2) Drill is conducted in silence, except for commands and reports.

(3) Commands and reports are given in a clear and positive manner.

(4) Errors are corrected instantly and on the spot by or through the officer or noncommissioned officer directly conducting the drill.

(5) Drill is practiced until all reactions to commands are automatic, instant, and effective.

(6) The ultimate in precision and speed is the goal.

(7) Drill is conducted at the fastest pace at which the squad can operate smoothly.

(8) Unless otherwise specified, the drill is performed when the vehicle is halted.

c. The drill is presented in chronological sequence of action, with explanatory notes. Paragraph titles agree with primary commands. Each command is followed by the individual actions performed under that command.

d. The drill contains a number of commands which are shown in bars, for example, **ICLEAR LOADING TRAYI**. These secondary commands are provided to insure coordination of action during early stages of training, for use when necessary at night, and for continued use when considered helpful. Well trained units must be prepared to anticipate these commands so that no delay in action results from their use. In advanced stages of training and combat, such commands are omitted from the drill at the option of the unit commander.

e. Throughout this drill the terms RIGHT, LEFT, FRONT, and REAR are used as follows:

(1) The end of the vehicle which contains the drivers' compartments is the FRONT; REAR refers to the end which contains the stowage compartment. The terms RIGHT and LEFT refer to the sides of the vehicle as viewed from the rear looking toward the front.

(2) When referring to the gun mount or any

of its parts, **FRONT** is that portion of the mount over which the gun barrels extend. The terms **RIGHT**, **LEFT**, and **REAR** refer to those portions of the mount indicated when looking from the mount out over the gun barrels.

**f.** The organization commander must constantly bear in mind that in performing the mission of his unit, maximum use must be made of all personnel available. During the training period, every man, to include clerks, cooks, truck drivers, and maintenance personnel, must be trained to perform squad duties to insure that prompt replacement of casualties can be made and that accurate, well aimed fire can be delivered after such replacement.

**32. FALL-IN. a.** The squad assembles in two ranks. The interval is 4 inches between files and 40 inches between ranks. The command is used when necessary to assemble the squad, and is always used prior to dismissing the squad from drill. (See fig. 19.)

**SL commands: FALL IN.**

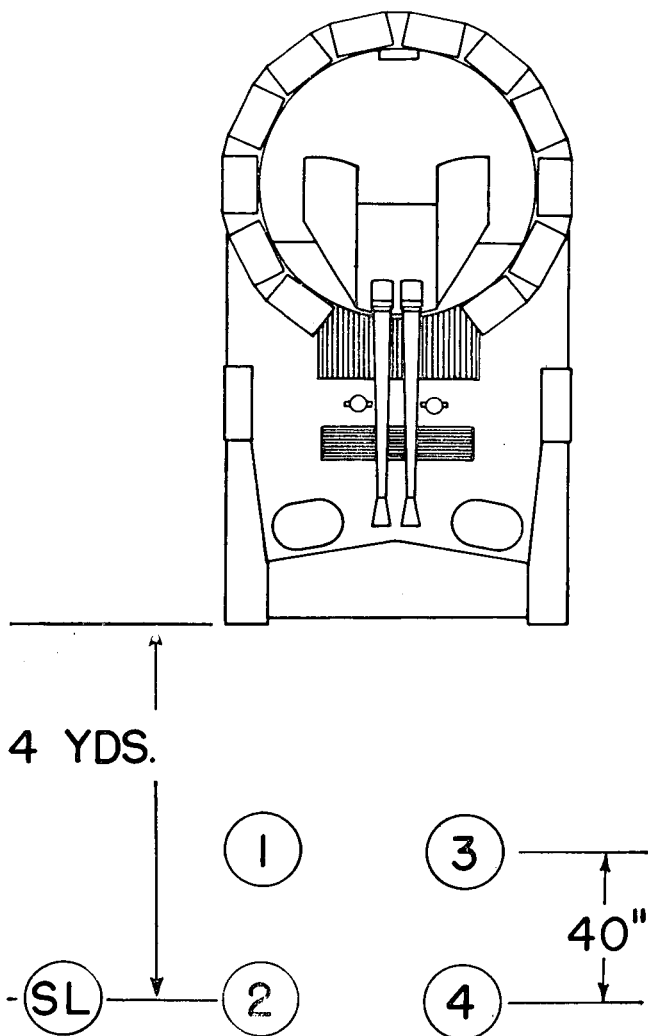
**2** takes his post 4 yards in front of the right track with his back to the vehicle as guide.

**4** falls in to the left of **2** at close interval.

**SL** falls in to the right of **2**, at close interval, completing the front rank.

**1** and **3**, covering **2** and **4**, respectively, **form** the rear rank at normal distance and close interval.

**b.** For dismounted formations and inspections



*Figure 19. Positions of squad at FALL IN.*

of the section, the twin 40-mm gun motor carriage M19 and the multiple gun motor carriage M16 are lined abreast with the former on the right. (See fig. 20.) The section leader takes his post 40 inches in front of 2 of the automatic weapons squad.

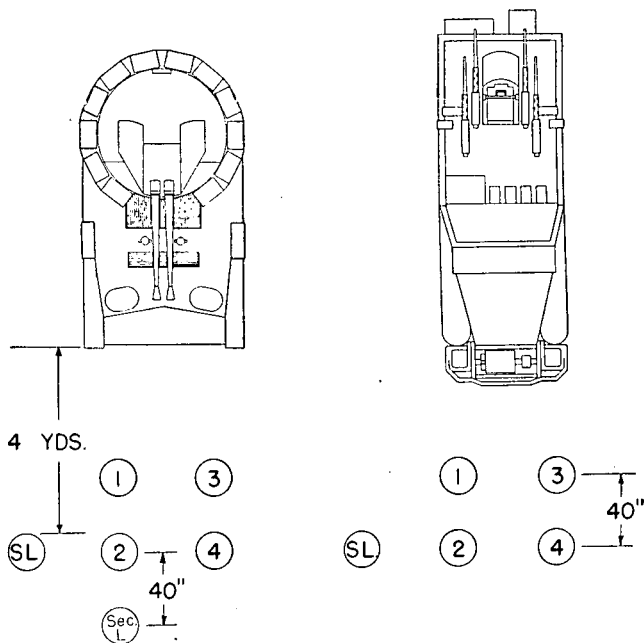


Figure 20. Positions of section for dismounted formations and inspections.

**33. COUNT OFF.** The squad being in formation, SL commands: **COUNT OFF.**

1 to 4 report their numbers consecutively.

**34. CALL OFF.** The squad being in formation,

**SL commands:** **CALL OFF**, when necessary to verify the squad.

Each member of the squad reports his assignment as follows:

- 1 reports, "*Gun pointer.*"
- 2 reports, "*Right cannoneer.*"
- 3 reports, "*Left cannoneer.*"
- 4 reports, "*Driver.*"

**35. CHANGE ORDER.** The squad being in formation,

**SL commands:** **CHANGE ORDER.**

All members of the squad change position as follows:

**SL** falls out and takes place of 4.

- 1 takes place of **SL**.
- 2 takes place of 1.
- 3 takes place of 2.
- 4 takes place of 3.

All members of the squad move simultaneously to new positions and dress right at close interval.

Change order drill is used to train each member of the squad in all the duties performed by the squad. It may be used at any time during drill.

**36. MOUNT.** The squad being in formation,

**SL commands:** **MOUNT**, does about face, and proceeds over right front of vehicle and right side of mount. (See fig. 21.)

- 2 proceeds to right side of vehicle and mounts over right rear.
- 4 does about face and proceeds over left front to driving compartment.
- 1 does about face and proceeds over center of vehicle and left side of mount.
- 3 proceeds to left side of vehicle and mounts over left rear.

**37. DISMOUNT.** The squad being in the vehicle, SL directs 4 to stop the vehicle.

SL commands: **DISMOUNT**, dismounts over right front. (See fig. 22.)

- 1 dismounts over left front.
- 2 dismounts from right side.
- 3 dismounts from left side.
- 4 sets brakes, stops engines, dismounts over left front.

All form as at the command, **FALL IN**.

### **38. START ENGINES.**

SL commands: **START ENGINES**.

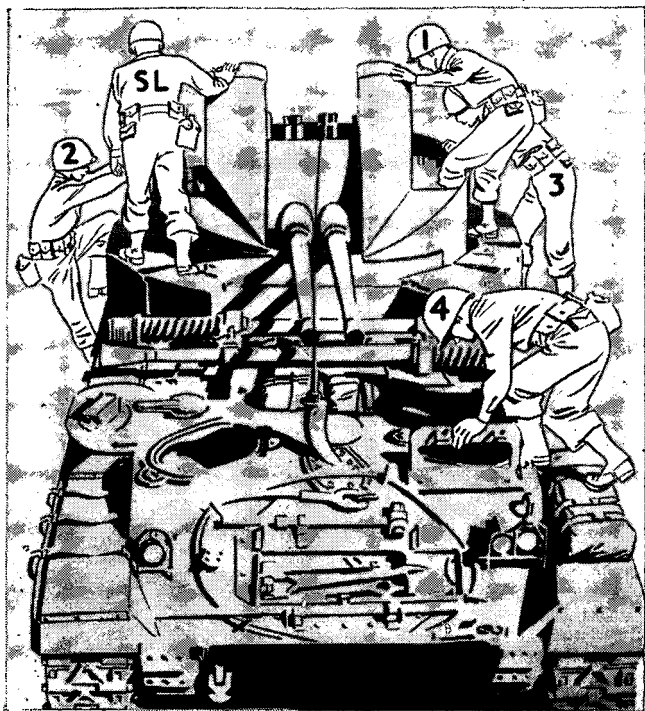
- 4 starts engines; adjusts engines to proper rpm. (See par. 18.)

### **39. STOP ENGINES.**

SL commands: **STOP ENGINES**.

- 4 stops engines. (See par. 20.)





*Figure 21. Positions during command MOUNT.*



*Figure 22. Positions during command **DISMOUNT**.*

**40. DISCONNECT TRAILER.** When occupying a position, it may be desirable to disconnect the trailer and conceal it away from the gun position.

**SL** directs **4** to desired location, commands: **DISCONNECT TRAILER.**

**4** moves vehicle as directed by **SL.**

**SL 1, 2, and 3** dismount.

**SL** disconnects safety chains, opens pintle hook, pulls out spring latch of trailer, and drops parking wheel into position.

**SL, 1, 2, and 3** take positions on both sides of drawbar; lift drawbar to clear lunette eye from pintle hook; push drawbar sideways and lower trailer to rest on caster.

**SL** locks hand brake of trailer.

**SL, 1, 2, and 3** mount vehicle.

## **Section II. PREPARATION FOR ACTION**

**41. GENERAL.** It is a fundamental requirement that **EXAMINE EQUIPMENT** and **ORIENT** be carried out prior to any action drill, motor marches, practice firing, or movement under combat conditions, and that **SL** insures the correction of any deficiencies immediately. **EXAMINE EQUIPMENT** and **ORIENT** are not speed drills. They should be performed carefully, thoroughly, and accurately.

### **42. EXAMINE EQUIPMENT.**

**SL** commands: **EXAMINE EQUIPMENT**; supervises all members as they examine equipment; insures that recoil cylinders are full, secure, and properly adjusted; inspects equilibrators;

examines barrels; checks level of oil in oil gears; checks desiccators on inverter, oil gears, and distribution box; checks interphone operation; assists 2 to relieve springs; engages (depresses) and disengages (raises) azimuth switch lever as required; runs speed dial from zero to maximum and returns with both handwheels; rotates course arrow through  $360^{\circ}$  with both controls (*Never turn the arrow directly by hand; always use the handwheel*); observes to see that, with a speed set in, the arrow remains on a fixed point when the gun is traversed; checks tightness of mounting bracket and linkages.

- 1 unlocks azimuth and elevation traveling locks; lowers drive controller; raises elevation switch lever; attaches and engages elevating hand operating crank. (*When operating mount manually, both the azimuth and elevation switch levers should be in the up position. For power operation both switches must be in the down position*); checks operation of manual elevating mechanism; checks equilibrators; disengages and removes elevating hand operating crank; raises and locks drive controller; depresses elevation switch lever; traverses and elevates the guns in both directions with power control; turns on safety switch; tests firing triggers and foot firing pedal while 2 and 3 observe firing mechanism on guns; checks reflex sight; adjusts seat; checks interphone operation; assists 3 to relieve springs.

- 2 checks to be sure right gun is not loaded; insures top and side covers are properly closed and locked; attaches and engages traversing hand operating crank; checks operation of manual traversing mechanism.

*Note. Manual traversing operation is tested at same time 1 tests in elevation.*

Inspects azimuth reflex sight; removes and disengages traversing hand operating crank; pulls hand operating lever fully to rear and sets automatic loader feed control thumb lever to left; puts pressure on hand operating lever, while SL exerts downward pressure on outer extractor releasing lever, moves hand operating lever to front hand operating lever latch bracket and listens for click of firing pin; with outer safety lever in all three positions, observes firing mechanism while 1 operates triggers and firing pedal; sets outer safety lever at SAFE; reports, "Safe"; sets automatic loader feed control thumb lever to right; inspects automatic loading tray and automatic loader; insures breechblock is open; relieves springs, assisted by SL; insures outer safety lever is at SAFE, verifies that cartridge case deflector channel is lowered and secure; checks ammunition, tools, and spare parts.

- 3 checks to be sure left gun is not loaded; insures that top and side covers are properly closed and locked; pulls hand operating lever fully to rear and sets automatic loader feed

control thumb lever to right; puts pressure on hand operating lever, while 1 exerts downward pressure on outer extractor releasing lever, moves hand operating lever to front hand operating lever latch bracket, and listens for click of firing pin; with the outer safety lever in all three positions, observes firing mechanism while 1 operates triggers and firing pedal; sets outer safety lever at SAFE; reports, "*Safe*"; sets automatic loader feed control thumb lever to left; inspects automatic loading tray and automatic loader; insures breechblock is open; relieves springs, assisted by 1; verifies that outer safety lever is at SAFE, verifies that cartridge case deflector channel is lowered and secure; checks ammunition, tools, and spare parts.

- 4 Inspects gasoline, oil, and water in vehicle and extra supply. *Caution: When checking the water and the engines are hot, turn the filler cap just enough for the pressure to escape before removing cap.* Starts engines, warms them up slowly; checks readings on instrument panel; tests foot pedals and steering levers; tests siren and ventilating blower; inspects armored doors and periscopes; checks lights; checks interphone operation; checks batteries; inspects track mechanism; checks vehicle tools and spare parts.

*Note. Sec. L checks operation of radio; supervises check of interphone system; checks radio and interphone spare parts.*

**43. REPORT.** When SL observes that the squad has completed their examination,

SL commands: **REPORT.**

1 reports, "*Drive controller and firing mechanism in order.*"

2 reports, "*Right gun and ammunition in order.*"

3 reports, "*Left gun and ammunition in order.*"

4 reports, "*Vehicle in order.*"

SL reports to section leader, "*Squad in order.*"

*Note. Should any malfunction exist that cannot be corrected, it is reported to SL by the squad member responsible for the inspection of the particular piece of equipment. SL reports any deficiencies to the section leader.*

**44. ORIENT.** Orientation drill is performed every time the equipment is to be used. Except when attack is imminent, **ORIENT** will follow **EXAMINE EQUIPMENT**.

*Note. Below it is assumed that the following conditions prevail when the command, ORIENT, is given:*

*The members of the squad are at their post as at the command, MOUNT.*

*The guns are loaded, pointed in the direction of anticipated attack, and elevated to 30° or normal standby direction.*

*The power supply and mount are in satisfactory operating condition, and mount is set for power control.*

SL commands: **ORIENT:** [commands: **MANUAL CONTROL.**]

SL, 1, 2, and 4 perform **MANUAL CONTROL FROM POWER CONTROL** drill. (See par. 56.)

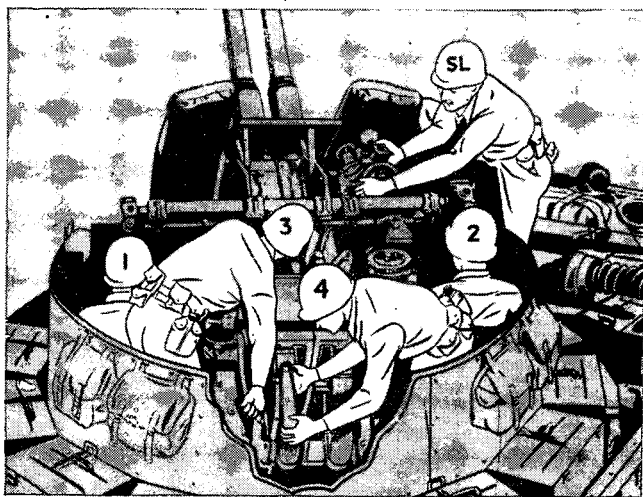
**[SL commands: CLEAR LOADING TRAY.]**

- 3 and 4 place outer safety lever at SAFE; report, "*Safe.*"
- 1 elevates guns to 30°.
- 3 places his hands behind automatic loading tray of right gun.
- 4 pulls hand operating lever of right gun fully to rear, releasing round on automatic loading tray.
- 3 catches round as it slides off automatic loading tray; places it in appropriate ammunition container.
- 4 places hand operating lever of right gun in front hand operating lever latch bracket; places his hands behind automatic loading tray of left gun.
- 3 pulls hand operating lever of left gun fully to rear, releasing round on automatic loading tray.
- 4 catches round as it slides off automatic loading tray; places it in appropriate ammunition container.
- 3 places hand operating lever of left gun in front hand operating lever latch bracket.
- 1, as soon as both rounds are off automatic loading trays, depresses guns until cartridge case deflector channels are clear of chutes.
- 3 removes cartridge case deflector channel pin of left gun and raises cartridge case deflector channel; replaces pin.
- SL obtains muzzle bore sight; places bore sight in muzzle of left gun (if muzzle bore sight is

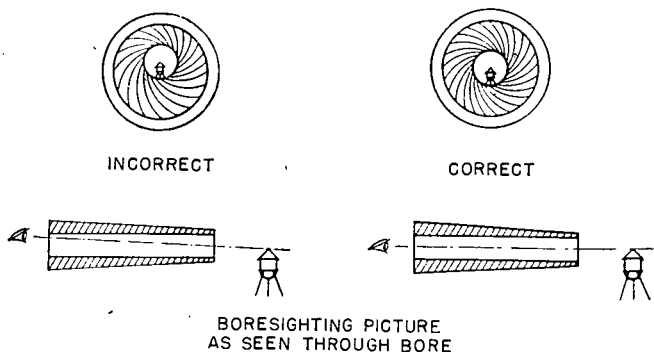


loose, withdraws it, applies coating of grease, replaces it in muzzle) or places cross hairs on muzzle of left gun; points at and describes orienting point. SL zeroes speed dial; removes bore sighting plug; rotates indicator assembly forward; inserts bore sighting plug in bore sighting boss. (See fig. 23.)

SL looks through bore of left gun; directs 1 and 2 to move gun until bore is exactly on orienting point (figs. 24 and 25); reports, "**On.**" 1 and 2 move guns as directed by SL.



*Figure 23. Positions during command **ORIENT** (SL putting indicator assembly in bore sighting position, 1 holding guns at 30°, 2 at traversing hand operating crank, 3 and 4 removing round from loading tray).*



*Figure 24. Correct and incorrect method of placing axis of bore on orienting point.*

*Note. 2 must insure that sight cables do not bend sharply while indicator assembly is forward during orientation.*

- 1 and 2 depress azimuth and elevation switch levers to lock gun on orienting point.
- 1, when SL reports, "**On,**" checks alinement of his reflex sight on orienting point; if necessary, loosens adjusting screws; puts reflex sight exactly on orienting point; tightens adjusting screws, verifies alinement; reports, "**On.**"
- 2, when SL reports, "**On,**" checks alinement of his reflex sight on orienting point; if necessary loosens adjusting screws; puts reflex sight exactly on orienting point; tightens adjusting screws; verifies alinement; reports, "**On.**"
- SL checks both reflex sights to insure that they are accurately on orienting point.

SL removes boresighting plug from boresighting boss; raises indicator assembly; inserts plug.

1 and 2 place speed ring sights in position for use; check alinement of speed ring sights on orienting point; if necessary, make lateral and vertical adjustments; reports, "On."

SL checks both speed ring sights to insure that they are accurately on orienting point; commands: **POWER CONTROL**.

1 raises elevation switch lever.

SL, 1, 2, and 4 perform **POWER CONTROL FROM MANUAL CONTROL** drill. (See par. 57.)

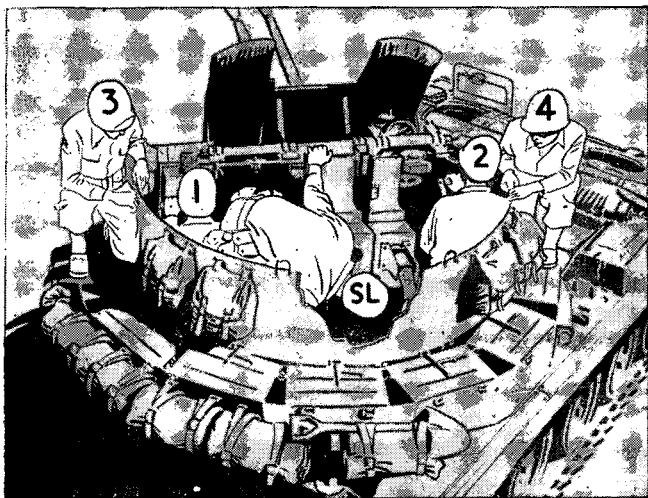


Figure 25. Positions during command **ORIENT** (SL alining axis of bore on orienting point, 1 and 2 at hand operating cranks moving guns as directed by SL).

**45. PREPARE FOR ACTION.** The members of the squad being at their posts as at command, **MOUNT.**

**SL** commands: **PREPARE FOR ACTION;** directs 4 to position weapon will occupy. (See fig. 26.)

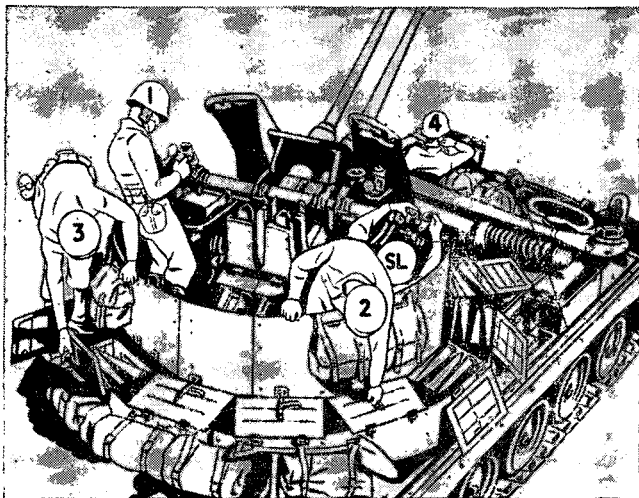
*Note. No provision has been made for leveling the weapon, therefore, ground that is level, or very nearly level, should be selected for the firing position. Leveling of the mount is desirable and when time permits should be accomplished by digging out beneath one or both tracks. The level can be checked by placing a gunner's quadrant on one of the guns and traversing through 360°.*

4 moves vehicle to position designated by **SL**; sets brakes; lowers radio antenna; adjusts engines to proper rpm; (puts on interphone equipment if not already on).

*Note. Whenever the mount is being operated by power control, 4 starts one or both engines and maintains rpm necessary to show a charge rate of 50 amperes on the ammeter.*

1 unlocks traveling locks; removes reflex sights and reflector plates from chest; passes azimuth reflex sight and reflector plate to **SL**; installs elevation reflex sight and reflector plate; pushes elevation switch lever down; elevates to 30°; puts on interphone equipment.

*Note. The elevation switch level should be kept in the up position except when the mount is actually being operated by power control to prevent overheating of the oil gears.*



*Figure 26. Positions during command **PREPARE FOR ACTION** (SL installing reflector plate, 1 installing reflex sight, 2 and 3 opening ammunition containers, 4 putting on interphone equipment).*

SL checks that azimuth switch lever is down; receives and installs azimuth reflex sight and reflector plate; puts on interphone equipment; sets standby speed in computing sight; observes field of fire.

2 opens the six ammunition containers on right side.

3 removes automatic loader cover; opens the six ammunition containers on left side.

#### 46. PREPARE FOR ACTION, MANUAL CONTROL.

If power control system is inoperative or if it is not desired to use power control,

**SL** commands: **PREPARE FOR ACTION, MANUAL CONTROL**; directs 4 to position weapon will occupy.

- 4 moves vehicle to position designated by **SL**; sets brakes; stops engine; insures master battery switches remain ON; lowers radio antenna; (if directed by **SL**, takes off interphone equipment; proceeds to gun mount; takes post of right cannoneer; opens the six ammunition containers on right side; performs duties of right cannoneer).

*Note. At manual control, SL directs 4 to take over duties of right cannoneer when it is desired. If no right cannoneer is available, 3 performs the duties of right cannoneer after he has completed duties on left gun except during command FIRE. 3 reloads the right gun during firing when it does not interfere with the loading of the left gun.*

- 1 unlocks traveling locks; removes reflex sights and reflector plates from chest; passes azimuth reflex sight and reflector plate to 2; installs elevation reflex sight and reflector plate; raises elevation switch; lowers and locks drive controller; attaches and engages elevating hand operating crank; elevates to 30°; puts on interphone equipment; performs duties of elevation tracker.

**SL** raises azimuth switch lever; puts on interphone equipment; takes post standing in rear of seat; sets standby speed in computing

sight; observes field of fire; resumes duties of lead setter, using upper controls.

2 takes post in SL's seat; receives and installs azimuth reflex sight and reflector plate; attaches and engages traversing hand operating crank; traverses to expected direction of attack; performs duties of azimuth tracker.

3 removes automatic loader cover; opens all ammunition containers; resumes duties of left cannoneer.

**47. LOAD.** Normally the guns are loaded as soon as **PREPARE FOR ACTION** is completed.

**SL commands: LOAD.** (See fig. 27.)

2, working on right gun, insures outer safety lever is at **SAFE**; reports, "**Safe**"; insures that automatic loader feed control thumb lever is at right; pulls hand operating lever to rear; moves it slightly forward, and engages it in rear hand operating lever latch bracket; obtains loaded clip and places palm of left hand against base of bottom round, and palm of right hand against next to bottom fuze so as to support bottom fuze also; adjusts position of hands so that lower edges of palms touch front and rear automatic loader guides; drops loaded clip into automatic loader; presses down hard on top round with both hands until bottom round drops to automatic loading tray; obtains another loaded clip and drops it in automatic loader in same manner; remains ready to feed additional ammunition into right gun.

**Caution:** Care must be taken when working on a loaded gun because if a round is pushed into the barrel, it will be fired even if the outer safety lever is at **SAFE**.

3 working on left gun, insures outer safety lever is at **SAFE**; reports, "**Safe**"; insures that automatic loader feed control thumb lever is at left; pulls hand operating lever fully to rear; moves it slightly forward, and engages it in rear hand operating lever latch bracket; obtains loaded clip and places palm of right hand against base of bottom round, and palm of left hand against next to bottom

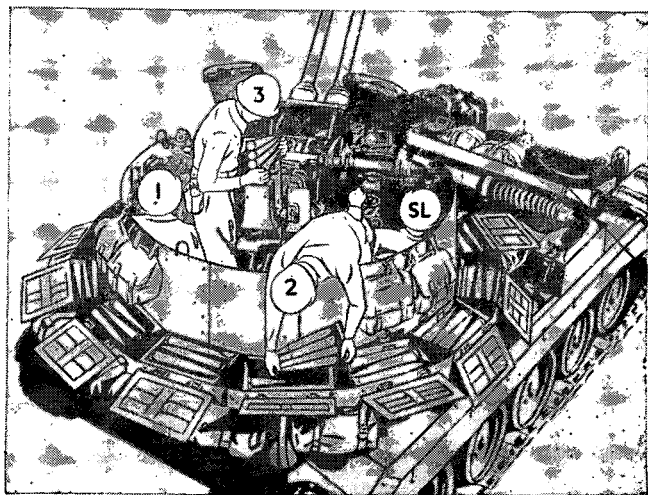


Figure 27. Positions during command **LOAD** (SL in position to use lower controls, 1 at drive controller, 2 obtaining loaded clip, 3 dropping loaded clip in automatic loader).



fuze so as to support bottom fuze also; adjusts position of hands so that lower edges of palms touch front and rear automatic loader guides; drops loaded clip into automatic loader; presses down hard on top round with both hands until bottom round drops to automatic loading tray; obtains another loaded clip and drops it in automatic loader in same manner; remains ready to feed additional ammunition into left gun.

### Section III. ACTION COMMANDS

**48. GENERAL.** Action drill is conducted with the vehicle at a halt. Upon appearance of a target, SL or any other member of the squad who sees or hears the target calls out, "*Target,*" and points out the approximate location. SL commands: **TARGET**, without delay. Immediately upon hearing the report, each member of the squad prepares for action as indicated by the command **PREPARE FOR ACTION**.

#### **49. TARGET.**

*Note. In the following drill it is assumed that the conditions stated prevail when the command **TARGET** is given:*

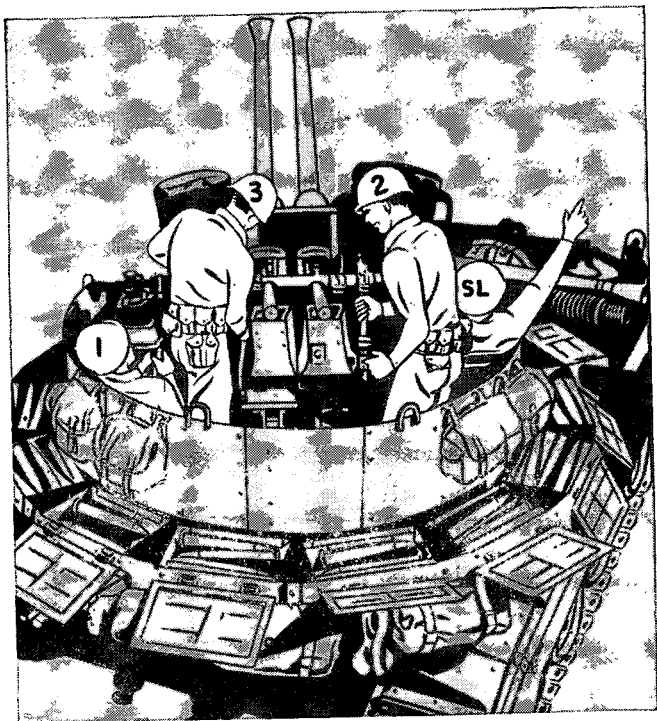
*All members of the fire unit are at their posts as at the command **MOUNT**.*

*The engines are operating properly, the mount is in proper operating condition and set for power control, and the computing sight is accurately oriented.*

*The guns are loaded, pointed in the direction of anticipated attack, and elevated to 30° or other standby direction.*

*The standby speed is set in the computing sight.*

SL commands: **TARGET** (fig. 28) ; points in direction of target; if more than one target is visible in direction indicated, he designates desired target as necessary (FM 44-51); continues to observe target; assists 1 in picking up target; estimates target's speed and direction of flight; sets target speed



*Figure 28. Positions during command **TARGET** (SL pointing to target, 1 looking in direction to pick-up target, 2 and 3 placing hand operating levers in front hand operating lever latch brackets).*

using lower set of controls computing sight (if estimated speed varies more than 50 mph from standby setting); aligns arrow with target's course, with arrow's head pointing in direction of travel.

*Note. Periodically 2 and 3 set recoil indicator pointer to minimum, read length of recoil after guns are fired, make necessary adjustments to recoil oil when time permits, reset recoil indicator pointer, and check again if adjustment was necessary.*

- 1 depresses elevation switch lever if in up position; traverses and elevates (or depresses) guns until target is in his sight; tracks intersection of cross hairs on center of mass of target; reports, "**On**," when tracking steadily. (If target is lost, he reports "**Lost**.")
- 2 places hand operating lever of right gun in front hand operating lever latch bracket; insures that automatic loader feed control thumb lever is turned to right; insures that automatic loader is full; stands ready to serve right gun.
- 3 places hand operating lever of left gun in front hand operating lever latch bracket; insures that automatic loader feed control thumb lever is turned to left; insures that automatic loader is full; stands ready to serve left gun.
- 4 remains in driver's compartment; insures that master battery switches are ON; operates engines; insures that engines are operating at proper rpm.

**50. ENGAGE.** The command **ENGAGE** is given as soon as the target is determined as hostile and is to be fired on. Often it is combined with the command **TARGET** as **TARGET-ENGAGE**.

**SL** commands: **ENGAGE**, when target is recognized as hostile (command may also be: **ENGAGE, AUTO-FIRE**); continues to set speed and direction of flight in computing sight.

- 1 continues to track target; turns firing circuit switch ON.
- 2 and 3 place outer safety levers to **SINGLE FIRE** (if command is, **ENGAGE, AUTO-FIRE**, they place outer safety levers to **AUTO**); stand ready to feed additional loader clips.
- 4 continues to maintain proper operation of engines.

**51. FIRE.** The command **ENGAGE** having been given,

**SL** when 1 has reported, "**On,**" commands: **FIRE**, when he has determined target is at range to open fire. (See FM 44-51.)

- 1 presses firing trigger or foot firing pedal; tracks target, keeping intersection of cross hairs on center of mass of target.

*Note. For single fire, press the trigger or foot firing pedal at regular intervals for each shot at the desired rate. For automatic fire, hold the firing trigger or foot firing pedal down. Automatic fire at a reduced rate down to 90 pounds per gun per minute can be accomplished by adjustment of the counterrecoil control rod valve spindle on the guns.*

**SL** continues to set target's speed and course; observes tracers and adjusts settings in accordance with FM 44-51.

- 2 fills automatic loader of right gun as required.
- 3 fills automatic loader of left gun as required.
- 4 operates engines and maintains proper rpm.

**52. CEASE FIRING.** When target is destroyed, passes out of range, or firing should stop for reasons of safety, drill, or malfunction,

SL commands: **CEASE FIRING**, continues to set in estimated target speed and course direction.

- 1 releases firing trigger (or foot firing pedal); turns safety switch OFF; continues to track target.
- 2 and 3 place outer safety levers at SAFE; report "*Safe*"; clear mount of ammunition clips; fill automatic loaders; stand by ready to serve their guns.
- 4 continues to operate engines and maintain proper rpm.

**53. CEASE TRACKING.**

SL commands: **CEASE TRACKING**; sets standby speed in computing sight; observes field of fire for new targets.

- 1 ceases tracking; elevates to 30° and traverses to anticipated direction of attack; observes field of fire for new targets; pulls up elevation switch lever.
- 2 and 3 insure outer safety levers are at SAFE; place their hand operating levers in rear hand operating lever latch brackets; fill

automatic loaders; clear away empty brass and ammunition clips.

- 4 continues to operate engines and maintains proper rpm.

**54. CHANGE TARGETS.** Any member of the squad observing a new target offering a threat calls out, "*New target,*" and points to it.

**SL**, upon recognizing new target as hostile and presenting a greater threat than the one being engaged, commands: **CHANGE TARGETS**; points in direction of target; if more than one target is available in new direction indicated, he designates target as necessary; when **1** ceases firing, assists **1** in picking up target; estimates target's speed and direction of flight; sets target speed using lower set of controls of computing sight (if estimated speed varies more than 50 mph from speed set in): alines arrow with target's course with arrow's head pointing in direction of travel; reports, "*Set.*"

- 1** releases firing trigger (or foot firing pedal); traverses and elevates (or depresses) guns until target is in his sight; tracks intersection of cross hairs on center of mass of target; opens fire when tracking is steady without further command after **SL** reports, "*Set.*"

- 2** and **3** insure that automatic loaders are full.

- 4 operates engines and maintains proper rpm. Squad resumes duties as at the command, **FIRE.**

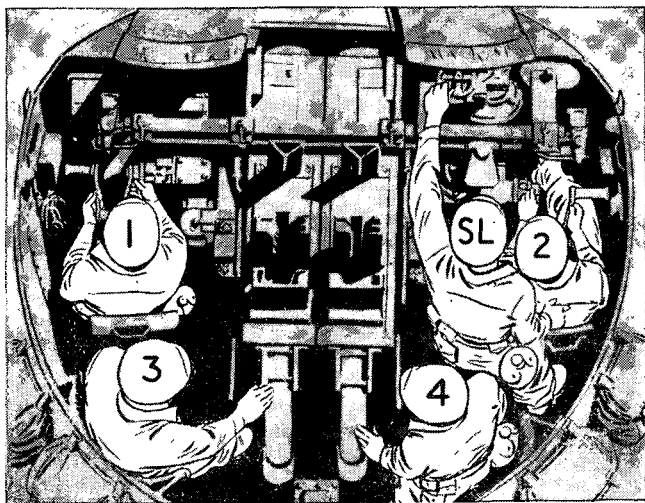
**55. TARGET LOST.** When target is obscured by smoke, a cloud, or some feature of terrain,

- 1 ceases fire and reports, "**Lost**"; does not change tracking rates.
  - 2 and 3 refill automatic loader as necessary.
  - SL watches for target; coaches 1; when target reappears, quickly makes proper course arrow and speed settings; reports, "**Set.**"
  - 1, when target reappears, quickly gets on target; opens fire without further command.
- Squad resumes duties as at command, **FIRE.**

**56. MANUAL CONTROL FROM POWER CONTROL.** The mount being operated by power control and power control system becomes inoperative (or when orienting),

- SL commands: **MANUAL CONTROL.** (See fig. 29.)
- 4 stops engines; insures master battery switches are ON. (Proceeds to gun mount if directed by SL, performs duties of right cannoneer. See note, par. 46.)
  - 1 raises elevation switch lever; lowers and locks drive controller; attaches and engages elevating hand operating crank; elevates to 30°; performs duties of elevation tracker.
- SL raises azimuth switch lever; takes post standing in rear of seat; sets standby speed in computing sight; observes field of fire; resumes duties of lead setter.
- 2 insures outer safety lever is at **SAFE**; reports, "**Safe**"; takes post in SL's seat; attaches and engages traversing hand operat-





*Figure 29. Positions during command **MANUAL CONTROL** (SL in position to use upper controls, 1 and 2 attaching hand operating cranks, 3 and 4 in position to serve guns).*

ing crank; traverses to expected direction of attack; performs duties of azimuth tracker.

- 3** remains at post; insures outer safety lever is at **SAFE**; reports "**Safe**"; resumes duties of left cannoneer.

**57. POWER CONTROL FROM MANUAL CONTROL.** The mount being operated by manual control and power control system is made operative (or upon completion of orientation),

**SL commands: POWER CONTROL.**

- 4** (if performing duties of right cannoneer, insures outer safety lever is at **SAFE**; reports,

**"Safe")**; proceeds to driving compartment; starts engines; adjusts rpm; resumes duties of driver.

- 1 removes and disengages elevating hand operating crank; raises and locks drive controller; pushes down elevation switch lever; elevates to 30°; traverses to expected direction of attack; resumes duties of gun pointer; raises elevation switch lever.
  - 2 removes and disengages traversing hand operating crank; takes post and resumes duties of right cannoneer.
  - 3 insures outer safety lever of left gun is at **SAFE**; reports, **"Safe"**; remains at post; resumes duties of left cannoneer.
- SL** takes post in seat; pushes down azimuth switch lever; observes field of fire; resumes duties of lead setter.

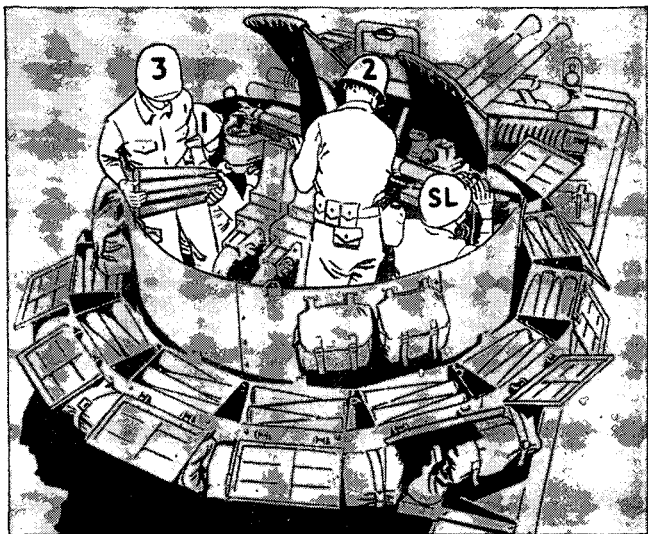
**58. MOVING SURFACE TARGET.** In the following drill it is assumed that all members of the squad are at their posts as at command **MOUNT**, the mount is set for power control, and the guns are loaded with HE ammunition. To engage a moving target such as a mechanized vehicle or PT boat,

**SL** commands: **MOVING SURFACE TARGET**; points in direction of target; if more than one target is visible in direction indicated, he designates desired target as necessary; (if AP ammunition is to be used, commands: **AP** following above command); sets speed

dial to **ZERO**; continues to observe target; assists **1** in picking up target; estimates apparent target length lead as prescribed in FM 44-51; announces lead in number of apparent target lengths and height as "**Lead, Two-Down, One.**" (See fig. 30.)

- 1** pushes down elevation switch lever; turns ON firing circuit switch; traverses and depresses (or elevates) guns until target is in his sight; tracks-off center of mass of target the target lengths and heights ordered by **SL**; reports, "**On,**" when lead and tracking are correct.
- 2** and **3** set outer safety levers to **SINGLE FIRE**; place hand operating levers in front hand operating lever latch brackets. If **AP** is ordered, they set outer safety levers to **AUTO-FIRE** and return them to **SINGLE FIRE** as soon as **HE** rounds in automatic loader have been fired, unless **AUTO-FIRE** has been ordered.
- 2** fills automatic loader of right gun (with **AP**, if **AP** is ordered); insures that automatic loader feed control thumb lever is turned to right; stands ready to serve right gun.
- 3** fills automatic loader of left gun (with **AP**, if **AP** is ordered); insures that automatic loader feed control thumb lever is turned to left; stands ready to serve left gun.

**SL**, when **1** reports, "**On,**" commands: **FIRE.**



*Figure 30. Positions during command **MOVING SURFACE TARGET** (SL observing through field glasses, 1 tracking target, 2 and 3 ready to serve guns).*

**1** presses firing trigger or foot firing pedal;  
tracks target, keeping lead ordered by SL.

*Note. For single fire, press trigger or foot firing pedal at regular intervals for each shot at the desired rate. For automatic fire, hold firing trigger or foot firing pedal down.*

**SL** observes tracers and impacts; announces new leads in number of apparent target lengths and heights, based on observation.

*Note. New apparent target length leads announced always represent the total desired lead.*

2 and 3 fill automatic loaders with ammunition as required.

4 operates engines and maintains proper rpm.

*When target passes out of range or is destroyed and if no other target is to be engaged immediately,*

[SL commands: **SET TO SAFE.**]

1 turns safety switch OFF; elevates to 30°; traverses to expected direction of attack; raises elevation switch lever.

2 and 3 place outer safety levers at SAFE; place hand operating levers in rear hand operating lever latch brackets; report, "**Safe**"; clear away empty brass and ammunition clips.

**59. SURFACE TARGET—DIRECT—GUN POINTER CONTROL.** To fire on stationary surface targets such as a machine gun or observation post *within 1,500 yards* by direct fire, the following drill is used. It is assumed that all members of the squad are at their posts as at command **MOUNT**, the mount is set for manual control, and the guns are loaded with the type of ammunition to be used.

SL commands: **SURFACE TARGET—DIRECT—GUN POINTER CONTROL**; designates target to 1 and 2; sets speed dial to **ZERO**; assists 1 and 2 in getting on target.

2 traverses guns until vertical element of his sight is exactly on target; reports, "**On.**"

1 depresses (or elevates) guns until target is

in his sight; tracks-off the estimated amount required for superelevation; reports, "**On.**"

- 3** and **4** (see note, par. 46) place hand operating levers in front hand operating lever latch brackets; fill automatic loaders with ammunition; insure that automatic loader feed control thumb levers are turned to left on left gun, right on right gun; set outer safety lever of left gun to **SAFE** and right gun to **SINGLE FIRE**; stand ready to serve guns.

*Note. In the drill for surface targets the right gun is specified for adjustment of fire, however, the guns should be alternated each time fire is adjusted on a new target to prevent excessive wear on one gun. When the left gun is used the procedure remains essentially the same.*

**SL** commands: **FIRE ONE ROUND — RIGHT GUN.**

**1** presses foot firing pedal and fires one round.

**1** and **2** observe impact; correct sight setting by tracking-off to adjust for deviation of round from target; report, "**Set.**"

**SL** observes impact, assists **1** and **2** in applying corrections; when **1** and **2** report, "**Set,**" commands: **FIRE ONE ROUND — RIGHT GUN.**

*Note. 1 and 2 apply corrections after each round until fire has been adjusted on target.*

When fire has been adjusted on target,

[**SL** commands: **FIRE FOR EFFECT**]; if automatic fire is to be used, commands: **AUTO-FIRE.**

*Note. If at manual control during automatic fire the guns cannot be held steady on target, the azimuth and elevation switch levers can be depressed to lock the mount in position.*

- 3 places outer safety lever of left gun at SINGLE FIRE (unless **AUTO-FIRE** is ordered) ; stands ready to serve left gun.
- 4 refills automatic loader of right gun; (places outer safety lever at **AUTO-FIRE** if automatic fire is ordered) stands ready to serve right gun.

**SL commands: FIRE (number each gun) ROUNDS.**

- 1 presses foot firing pedal at desired rate for single fire or holds firing lever down for automatic fire, until number of rounds ordered by SL have been fired.
- 3 and 4 fill automatic loaders with ammunition as required.

*If no other target is to be engaged immediately,*

**[SL commands: SET TO SAFE.]**

- 1 elevates to 30°.
- 2 traverses to expected direction of attack.
- 3 and 4 place outer safety levers at SAFE; place hand operating levers in rear hand operating lever latch brackets; report, "**Safe**"; clear away empty brass and ammunition clips.

**60. SURFACE TARGET—DIRECT—QUADRANT.**

To fire on stationary surface targets *beyond 1,500*

*yards* by direct fire, the following drill is used. It is assumed that all members are at their posts as at command **MOUNT**, the mount is set for manual control, and the guns are loaded with the type of ammunition to be used.

**SL** commands: **SURFACE TARGET—DIRECT —QUADRANT**, designates target to **1** and **2**; sets speed dial to **ZERO**; places indicator assembly in boresighting position; assists **1** and **2** in getting on target; determines super-elevation necessary for range of target. (See FM 44-11.)

**1** depresses (or elevates) guns until horizontal element of his sight is exactly on target; reports, "**On.**"

**2** traverses guns until vertical element of his sight is exactly on target; reports, "**On.**"

**SL**, when **1** and **2** report "**On,**" places gunner's quadrant on right gun, measures angle of sight; adds angle of sight and required super-elevation algebraically, sets resultant angle (quadrant elevation) on gunner's quadrant; watches gunner's quadrant and instructs **1** to move guns vertically until they are set at quadrant elevation.

**1** elevates as instructed by **SL**.

**3** and **4** (see note, par. 46) place hand operating levers in front hand operating lever latch brackets; fill automatic loaders with ammunition; insure that automatic loader feed control thumb levers are turned to left on left gun, right on right gun; set outer safety lever of left gun to **SAFE** and right



gun to **SINGLE FIRE**; stand ready to serve guns.

**SL** commands: **FIRE ONE ROUND — RIGHT GUN.**

1 presses foot firing pedal and fires one round.

2 observes impact; corrects sight setting by tracking-off to adjust for lateral deviation of round from target; reports, "*Set.*"

**SL** observes impact; estimates vertical correction necessary; sets correction on gunner's quadrant; places gunner's quadrant on right gun; watches gunner's quadrant and instructs 1 to move guns vertically until they are set at corrected quadrant elevation.

1 elevates (or depresses) as instructed by **SL**.

**SL** commands: **FIRE ONE ROUND — RIGHT GUN.**

*Note. SL and 2 apply corrections after each round until fire has been adjusted on target.*

*When fire has been adjusted on target,*

[**SL** commands: **FIRE FOR EFFECT**; if automatic fire is to be used, commands: **AUTO-FIRE.**]

3 places outer safety lever of left gun at **SINGLE FIRE** (unless **AUTO-FIRE** is ordered); stands ready to serve left gun.

4 refills automatic loader; (places outer safety lever of right gun at **AUTO-FIRE** if automatic fire is ordered); stands ready to serve right gun.

**SL commands: FIRE (*number each gun*)  
ROUNDS.**

- 1 presses foot firing pedal at desired rate for single fire or holds firing lever down for automatic fire, until number of rounds ordered by SL have been fired.
- 3 and 4 fill automatic loaders with ammunition as required.

*If no other target is to be engaged immediately,*

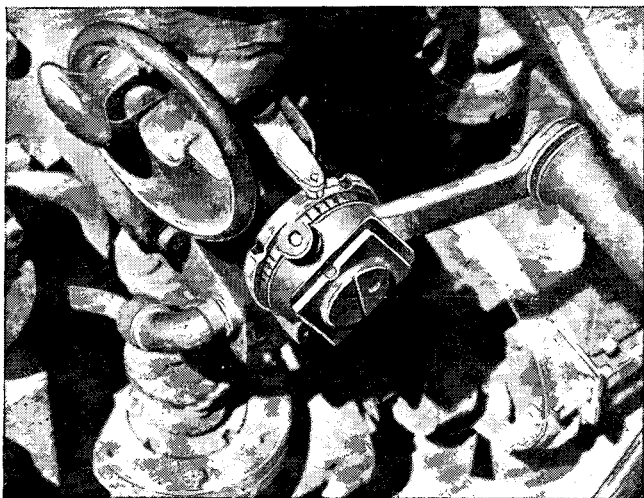
**[SL commands: SET TO SAFE.]**

- 1 elevates to 30°.
- 2 traverses to expected direction of attack.
- 3 and 4 place outer safety lever to SAFE; place hand operating levers in rear hand operating lever latch brackets; report, "*Safe*"; clear away empty brass and ammunition clips.

**51. SURFACE TARGET—INDIRECT FIRE.** To bring indirect fire on a surface target, the following drill is used. Communications must be available with an observer in an OP who designates targets, azimuth deflection from the aiming point, quadrant elevation, and corrections. The mount must be equipped with an improvised azimuth scale on the traversing hand operating crank (fig. 31) in order that the mount can be traversed a measured amount. (See FM 44-11.) It is assumed that all members are at their posts as at command **MOUNT**, the mount is set for manual control and the guns are loaded with the type of ammunition to be used.

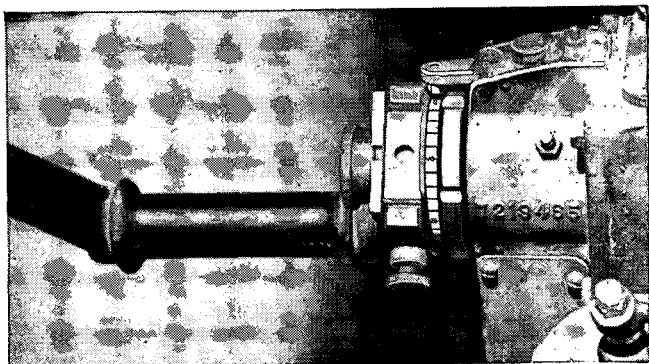
**SL** commands: **SURFACE TARGET—INDIRECT FIRE**; sets speed dial to **ZERO**; designates aiming point to **2**; assists **2** in getting on aiming point.

**2** traverses guns until vertical element of his sight is exactly on aiming point; zeroes traversing hand operating crank scale; reports, "**Set.**"



① *Traversing hand operating crank scale.*

*Figure 31. Traversing and elevating hand operating crank scales.*



② *Elevating hand operating crank scale.*

*Figure 31—Continued.*

**SL** obtains gunner's quadrant, sets quadrant elevation on quadrant; places gunner's quadrant on right gun; watches gunner's quadrant and instructs **1** to move guns vertically until guns are set at quadrant elevation. (See fig. 32.)

**1** elevates (or depresses) as instructed by **SL**.

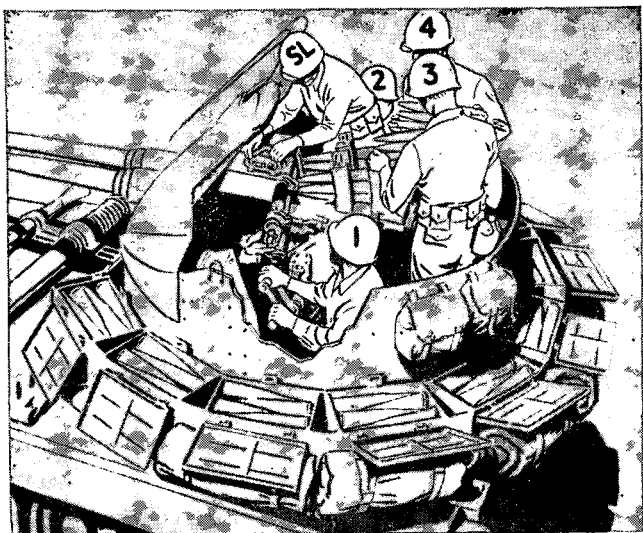
**3** and **4** (see note, par. 46) place hand operating levers in front hand operating lever latch brackets; fill automatic loaders with ammunition; insure that automatic loader feed control thumb levers are turned to left on left gun, right on right gun; set outer safety lever of left gun to **SAFE** and right gun to **SINGLE FIRE**; stand ready to serve guns.

**SL** commands: **FIRE ONE ROUND — RIGHT GUN.**

**1** presses foot firing pedal and fires one round.

- SL reports to OP, "***One away***"; receives corrections from OP; commands: **DIAL** \_\_\_\_\_  
(gives total number of mils from aiming point if lateral correction is necessary).
- 2 watches azimuth scale, traverses guns to azimuth setting ordered by SL; reports, "***Set.***"
- SL applies correction to gunner's quadrant (if vertical correction necessary); places quadrant on right gun; watches gunner's quadrant and instructs 1 to move guns vertically until guns are set at corrected quadrant elevation.
- 1 elevates (or depresses) as instructed by SL.
- SL commands: **FIRE ONE ROUND — RIGHT GUN.**

*Note. Corrections are applied after each round until fire has been adjusted on target.*



*Figure 32. Positions during command **SURFACE TARGET** —**INDIRECT FIRE** (SL placing gunner's quadrant on right gun, 1 elevating as directed by SL, 2 traversing number of mils ordered by SL, 3 and 4 ready to serve guns).*

When fire has been adjusted on target and the OP calls for fire for effect giving number of rounds desired,

[SL commands: **FIRE FOR EFFECT**; if automatic fire is to be used, commands: **AUTO-FIRE**.]

3 places outer safety lever of left gun at **SINGLE FIRE** (unless **AUTO-FIRE** is ordered); stands ready to serve left gun.

- 4 refills automatic loader; (places outer safety lever of right gun at AUTO-FIRE if automatic fire is ordered); stands ready to serve right gun.

**SL commands: FIRE (*number*) ROUNDS.**

- 1 presses foot firing pedal at desired rate for single fire or holds firing lever down for automatic fire, until number of rounds ordered by SL have been fired.

**SL reports to OP, “\_\_\_\_\_ on the way.”**

- 3 and 4 fill automatic loader with ammunition as required.

*When fire for effect has been completed, if additional rounds are not called for or if a new target is not assigned,*

**[SL commands: SET TO SAFE.]**

- 1 elevates to 30°.
- 2 traverses to expected direction of attack.
- 3 and 4 place outer safety levers at SAFE; place hand operating levers in rear hand operating lever latch brackets; report, “*Safe*”; clear away empty brass and ammunition clips.

**62. SURFACE TARGET—INDIRECT—LADDER.** To bring indirect fire rapidly on an area target, the following drill is used. Communications must be available with an observer at an OP who designates targets, azimuth deflections from the aiming point, quadrant elevation, and corrections.

The mount must be equipped with improvised azimuth and elevation scales on the hand operating cranks (fig. 31) in order that the mount can be traversed and elevated (or depressed) a measured amount. (See FM 44-11.) It is assumed that all members of the squad are at their posts as at command **MOUNT**, the mount is set for manual control, and the guns are loaded with the type of ammunition to be used.

**SL** commands: **SURFACE TARGET—INDIRECT —LADDER**; sets speed dial to **ZERO**; designates aiming point to **2**; assists **2** in getting on aiming point.

**2** traverses guns until vertical element of his sight is exactly on aiming point; zeroes traversing hand operating crank scale; reports, "**Set.**"

**SL** commands: **DIAL RIGHT (OR LEFT)**  
\_\_\_\_\_ **MILS.**

**2** watches azimuth scale, traverses guns number of mils and direction ordered by **SL**; zeroes traversing hand operating crank scale; reports, "**Set.**"

**SL** obtains gunner's quadrant, sets quadrant elevation on quadrant; places gunner's quadrant on right gun; watches gunner's quadrant and instructs **1** to move guns vertically until guns are set at quadrant elevation.

**1** elevates (or depresses) as instructed by **SL**; when guns are set at quadrant elevation, zeroes elevating hand operating crank scale; reports, "**Set.**"



3 and 4 (see note, par. 46) place hand operating levers in front hand operating lever latch brackets; fill automatic loaders with ammunition; insure that automatic loader feed control thumb levers are turned left on left gun, right on right gun; set outer safety lever of left gun to SAFE and right gun to SINGLE FIRE.

**SL commands: FIRE ONE ROUND — RIGHT GUN.**

1 presses foot firing pedal and fires one round.

**SL reports to OP, “*One away.*”**

1 watches elevating hand operating crank scale, depresses 2 mils; reports, “*Set.*”

2 watches traversing hand operating crank scale, traverses right 5 mils; reports, “*Set.*”

**SL commands: FIRE ONE ROUND — RIGHT GUN.**

1 presses foot firing pedal and fires one round.

**SL reports to OP, “*Two away.*”**

1 watches elevating hand operating crank scale; depresses 2 mils; reports, “*Set.*”

2 watches traversing hand operating crank scale; traverses right 5 mils; reports, “*Set.*”

**SL commands: FIRE ONE ROUND — RIGHT GUN.**

*Note. This procedure is continued until five rounds have been fired with a 5-mil change in azimuth and a 2-mil decrease in elevation for each round.*

*When the OP indicates the closest round for azimuth and the closest for elevation, respectively, such as 2 and 4, and the number of rounds to be fired for effect,*

**SL commands: FIRE FOR EFFECT—AZIMUTH 2—ELEVATION 4:** if automatic fire is to be used, commands: **AUTO-FIRE.**

- 1 sets guns to elevation of fourth round fired; reports, "**Set.**"
- 2 sets guns to azimuth of second round fired; reports, "**Set.**"
- 3 places outer safety lever of left gun at SINGLE FIRE (unless **AUTO-FIRE** is ordered); stands ready to serve left gun.
- 4 refills automatic loader; (places outer safety lever of right gun at **AUTO-FIRE** if automatic fire is ordered); stands ready to serve right gun.

**SL commands: FIRE (number each gun) ROUNDS.**

- 1 presses foot firing lever at desired rate for single fire or holds firing lever down for automatic fire, until number of rounds ordered by **SL** have been fired.

**SL** reports to **OP**, "                  *on the way.*"

- 3 and 4 fill automatic loader with ammunition as required.

*When fire for effect has been completed, if additional rounds are not called for or if a new target is not assigned,*

[SL commands: SET TO SAFE.]

- 1 elevates to 30°.
- 2 traverses to expected direction of attack.
- 3 and 4 place outer safety lever at SAFE; place hand operating levers in rear hand operating lever latch brackets; report, "Safe"; clear away empty brass and ammunition clips.

### 63. CHANGE BARRELS. RIGHT (LEFT) GUN.

*Note 1. When enemy action is possible, only one barrel is changed at a time so that the mount can be put into operation quickly.*

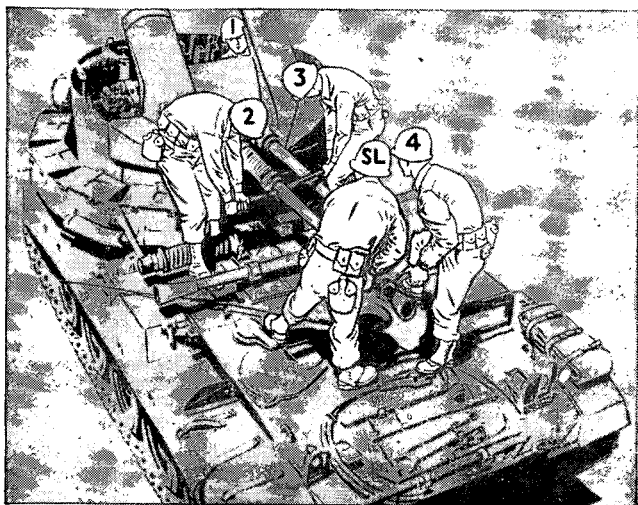
*Note 2. A white line-up mark should be painted on each barrel at the breech and muzzle end to indicate the bottom of the barrel when it is properly locked in the breech ring. These marks are an assistance to personnel when placing the flash guard wrench and barrel carrier on the spare barrel and when inserting barrel into gun breech casing.*

SL commands: **CHANGE BARRELS — RIGHT (LEFT) GUN** (fig. 33). [Commands: **CLEAR LOADING TRAY**.]

- 1 traverses gun over center front of carriage.
  - 1, 2, and 3 perform **CLEAR LOADING TRAY** drill for right (left) gun as prescribed in paragraph 66.
  - 2 (3) pulls hand operating lever fully to rear, then places hand operating lever in rear hand operating lever latch bracket; places outer safety lever to SAFE; reports, *Safe*.
- SL inserts breechblock locking pin in gun breech casing; turns gun breech cover latch lever;

raises gun breech casing top cover; opens cover until gun breech top cover catch holds cover open.

**Caution:** *Breechblock locking pin must be inserted without fail every time the barrel is removed, and the elevation traveling lock should be blocked so that it will not slip.*



*Figure 33. Positions during command **CHANGE BARRELS.***

SL, 2, 3, and 4 remove spare barrel from rack and place in convenient position for inserting in gun.

1 depresses guns to horizontal; raises elevation switch lever; engages traveling locks to hold gun at horizontal while removing and replacing barrels; lowers and locks drive

controller, attaches and engages elevating hand operating crank; remains in his seat and holds guns down while barrels are being changed.

- 2** arranges convenient supports upon which barrel is to be placed; obtains barrel carrier and flash guard wrench.

**Caution:** *Never close top cover with barrel removed; serious damage may result.*

- 2** and **3** place barrel carrier under right (left) barrel, making certain that lug engages recess; face breech end of barrel.

- SL** and **4** place flash guard wrench on barrel and lock wrench; face breech end of barrel.

[**SL** commands: **TURN.**]

- SL** and **1** turn wrenches one-half turn counter-clockwise.

*Note. When removing or replacing one barrel with the other barrel in the gun, it is necessary to turn the barrel part way and reset the wrench to complete the turn.*

[**SL** commands: **LIFT.**]

- SL**, **2**, and **3** take up weight of barrel on wrenches; continue to face breech end of barrel; withdraw barrel to front; proceed with barrel over front end of carriage; place barrel on convenient supports.

- 2** and **3** remove barrel carrier; place barrel carrier under spare barrel, engaging lug in recess; face breech end of barrel.

SL and 4 remove flash guard wrench; fasten on spare barrel and lock; face breech end of barrel.

[SL commands: **READY-UP.**]

SL, 2, 3, and 4 lift spare barrel; insert barrel carefully in gun; slide barrel into place.

SL and 4 turn wrench one-half turn clockwise; remove flash guard wrench.

2 and 3 remove barrel carrier.

SL closes top cover and secures latch; removes breechblock locking pin.

2 replaces barrel carrier and flash guard wrench with tools.

1 disengages and removes elevating hand operating crank; raises and locks drive controller; unlocks traveling locks.

All members of squad return to their posts.

**64. STOPPAGE.** The term "stoppage" denotes a failure of gun to fire. It may be the result of personnel, ammunition, or mechanical failure. When a stoppage occurs during combat, the cannoneer immediately attempts to clear stoppage. He does not, however, do anything which would interfere with continuous firing of the other gun. When a stoppage occurs during practice, firing is halted and immediate action is taken.

*If right (left) gun fails to fire,*

2 (3) checks to see if failure is due to lack of ammunition; if not due to lack of ammunition, calls, "**Stoppage**"; sets outer safety lever at SAFE; reports, **Safe**.

**SL (1)**, when **2 (3)** calls, "**Stoppage**," assists **2 (3)** as necessary.

**2 (3)** assisted by **SL (1)**, checks outer extractor releasing lever to see if breechblock is open or closed (if lever moves through about 90°, the breechblock is closed; if about 40°, the breechblock is open).

*If breechblock is open,*

**2 (3)** calls, "**Stoppage**," and assisted by **SL (1)** clears stoppage.

*If breechblock is closed,*

**2 (3)** calls, "**Misfire**," immediately recocks gun, and attempts to fire.

*Note. To cock the firing pin, the hand operating lever is pulled to the rear until the hand operating lever handle is in line with both upper automatic loader pawls. A slight relief in pressure is noticeable at this point and the lever should not be moved farther to the rear as additional movement would cause lowering of breechblock. The firing pin having thus been cocked, it is necessary only to return hand operating lever to front hand operating lever latch bracket. The forward movement of hand operating lever will release the firing pin.*

**2 (3)** assisted by **3 (2)** removes the round if the second attempt to fire has failed.

**SL** examines round.

*If primer has been struck,*

**2 (3)** places round in a safe place behind sand bags or other obstacle at least 20 yards away as directed by **SL**.

*If primer has not been struck*

- 2 (3)** assisted by **SL (1)** removes breechblock, tests firing mechanism and firing pin.

*If round has not been removed within 45 seconds and barrel is hot, SL directs further action as required.*

If water is available, it should be played on the barrel until barrel is cool, after which additional effort should be made to remove the round. If water is not available, all personnel should stand clear of gun until it is cool, after which additional efforts should be made to remove the round.

## **65. STANDBY, DIRECTION\_\_\_\_\_ , ELEVATION\_\_\_\_\_.**

*Note. It has been provided that following the command, CEASE TRACKING, the guns are made to point in the direction of anticipated attack and elevated to 30° or other normal standby direction. Therefore, the gun is normally pointed toward the center field of fire and elevated to 30° or other normal standby direction. In tactical set-ups this may prove unsatisfactory and another elevation may be designated as SOP for that situation. In this event or when, for any reason, it is desired to point the gun in a direction or at an elevation other than normal,*

**SL commands: STANDBY, DIRECTION\_\_\_\_\_ , ELEVATION\_\_\_\_\_.**

**(SL specifies the direction toward which the guns are to be pointed in azimuth, and the angle at which the guns are to be pointed in elevation.)**

- 1** traverses and elevates (or depresses) to indicate direction ; reports, "**Set.**"



## 66. CLEAR LOADING TRAY.

SL commands: **CLEAR LOADING TRAY.** (See fig. 34.)

**2** and **3** place outer safety levers at **SAFE**; reports; "**Safe.**"

**1** elevates guns to  $30^{\circ}$ .

**3** places his hands behind automatic loading tray of right gun.

**2** pulls hand operating lever of right gun fully to rear, releasing round on automatic loading tray.

**3** catches round as it slides off automatic loading tray; places it in automatic loader or appropriate ammunition container.

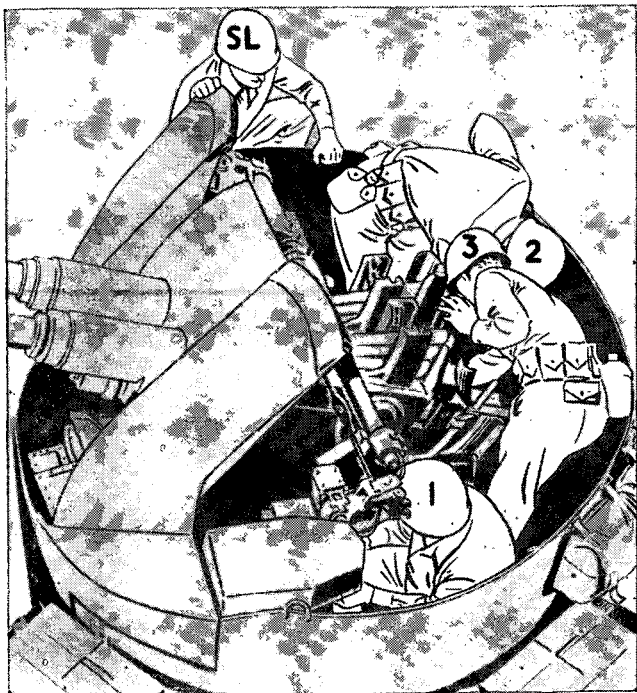
**2** places hand operating lever of right gun in front hand operating lever latch bracket; places his hands behind automatic loading tray of left gun.

**3** pulls hand operating lever of left gun fully to rear, releasing round on automatic loading tray.

**2** catches round as it slides off automatic loading tray; places it in automatic loader or appropriate ammunition container.

**3** places hand operating lever of left gun in front hand operating lever latch bracket.

**1**, as soon as both rounds are off automatic loading trays, returns guns to standby elevation.



*Figure 34. Positions during command **CLEAR LOADING TRAY** (SL supervising, 1 holding guns at 30°, 2 with hand operating lever fully to rear, 3 catching round).*

## **67. UNLOAD.**

**SL commands: UNLOAD.**

**2** and **3** place outer safety levers at **SAFE**; report, "**Safe.**"

**1** elevates guns to 30°.

**3** places his hands behind automatic loading tray of right gun.

- 2 pulls hand operating lever of right gun fully to rear, releasing round on automatic loading tray; while hand operating lever is fully to rear, sets automatic loader feed control thumb lever to left.
- 3 catches round as it slides off automatic loading tray; places it in appropriate ammunition container.
- 2 places hand operating lever of right gun in front hand operating lever latch bracket; places his hands behind automatic loading tray of left gun.
- 3 pulls hand operating lever of left gun fully to rear, releasing round on automatic loading tray; while hand operating lever is fully to rear, sets automatic loader feed control thumb lever to right.
- 2 catches round as it slides off automatic loader tray; places it in appropriate ammunition container.
- 3 places hand operating lever of left gun in front hand operating lever latch bracket.
- 2 inserts cartridge remover in automatic loader of right gun; removes rounds from top of automatic loader; insures that round on automatic loader feed rollers is removed; places rounds in appropriate ammunition container, sets automatic loader feed control thumb lever to right.
- 3 inserts cartridge remover in automatic loader of left gun; removes rounds from top of automatic loader; insures that round on automatic loader feed rollers is removed; places rounds in appropriate ammunition

container; sets automatic loader feed control thumb lever to left.

- 1 returns guns to previous elevation.

**68. RELIEVE SPRINGS.** Upon completion of the day's drill, or when the guns are to be left for a long period of time, it is desirable that tension of breech ring closing springs, breechblock firing pin springs, and cartridge rammer springs be relieved.

**SL** commands: **RELIEVE SPRINGS;** exerts a moderate pressure downward on extractor releasing lever of right gun.

- 2, after determining that right gun is unloaded, pulls hand operating lever fully to rear, thereby taking the force of cartridge rammer springs off of check or catch levers; places automatic loader feed control thumb lever to the left.

**SL**, pushing on extractor releasing lever, disengages extractors from breechblock.

- 2 closes breech slowly by moving hand operating lever into front hand operating lever latch bracket, thereby relieving the breech ring closing and breechblock firing pin springs; places outer safety lever to SINGLE FIRE; reports, "*Single fire.*"

- 1 exerts a moderate pressure downward on extractor releasing lever of left gun.

- 3, after determining that left gun is unloaded, pulls hand operating lever fully to rear, thereby taking the force of cartridge rammer springs off of check or catch levers; places

automatic loader feed control thumb lever to right.

- 1, pushing on extractor releasing lever, disengages extractors from breechblock.
- 3 closes breech slowly by moving hand operating lever into front bracket, thereby relieving the breech ring closing and breechblock firing pin springs; places outer safety lever to SINGLE FIRE; reports, "**Single fire.**"
- 1 presses firing trigger or foot firing pedal once, thereby releasing cartridge rammers.
- 2 places outer safety lever at SAFE; reports, "**Safe**"; returns automatic loader feed control thumb lever to right.
- 3 places outer safety lever at SAFE; reports, "**Safe**"; returns automatic loader feed control thumb lever to left.

**69. STAND FAST.** When SL desires to prevent or stop execution of a command already given, or to insure that all members of the squad remain vigilant at posts,

SL commands: **STAND FAST.** SL may also command: **STOP ENGINES.**

- 1 releases firing trigger or foot firing pedal (if he is firing).
  - 2 and 3 place outer safety levers at SAFE; report "**Safe.**"
- SL sets standby speed in computing sight.
- 4 operates engines and maintains proper rpm; if SL commands, **STOP ENGINES**, he stops engines as prescribed in paragraph 20.

**70. REST.** The command, **REST**, is given when firing has been temporarily suspended and it is considered undesirable to withdraw the squad from the weapon, or when it is necessary to keep the squad in action for long periods, ready to open fire on short notice. **SL** first gives orders for such work to be carried out as may be necessary. When this work has been completed,

**SL** commands: **REST**. **SL** may also command: **STOP ENGINES**.

2 and 3 check that outer safety levers are at **SAFE**; report, "**Safe**."

4 operates engines and maintains proper rpm; if **SL** commands, **STOP ENGINES**, he stops engines as prescribed in paragraph 20.

**SL** designates members to remain alert as look-outs.

All other members of the squad remain near their posts.

**71. CASUALTY REPLACEMENT.** In the event of casualties to personnel, replacements are detailed by **SL**. While in action each member of the squad must be prepared to assume duties of other crew members. The minimum number required for power control and operation of both guns is five. If only four men are available, the right cannoneer is dispensed with and the left cannoneer performs the duties of the right cannoneer after he has completed duties on left gun except during command, **FIRE**. The right gun is allowed to fire those rounds in the automatic loader but the left

cannoneer reloads the right gun during firing when it does not interfere with the loading of the left gun. If only three are available, the lead setter is dispensed with and the gun pointer fires by speed ring or tracer control. If only two men are available, both guns are filled with ammunition and the mount is set for power operation between engagements. During engagements, the driver performs the duties of cannoneer and the gun pointer fires on the target, using speed ring or tracer control. If only one man is available, the guns are filled with ammunition and set to fire. During alerts the engines are started and the mount set for power control. When a target appears, the gun pointer fires on it until the rounds in the guns are expended, then reloads and resumes firing.

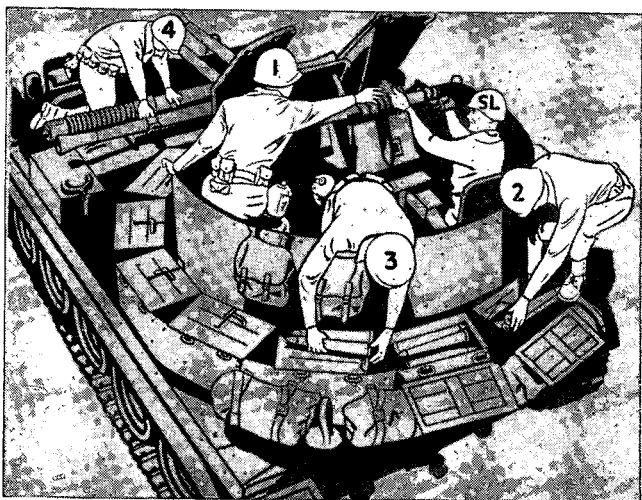
#### **Section IV. MARCH ORDER**

**72. GENERAL.** The drill prescribed in the following paragraph provides for the removal of reflex sights, replacing the automatic loader cover, and installing muzzle covers as part of march order procedure. However, if action on the march is anticipated, reflex sights are left in position and the automatic loader and muzzle covers are not installed.

#### **73. MARCH ORDER.**

**SL** commands: **MARCH ORDER**; supervises preparation of guns and carriage for movement; if time is available, directs and assists in the cleaning of guns and carriage; removes azimuth reflex sight and reflector

plate and passes them to 1, receives reports from 2 and 3 as to amount of ammunition; reports total amount of ammunition to Sec. L; reports to Sec. L when guns and mount are in march order. (See fig. 35.)



*Figure 35. Positions during command **MARCH ORDER** (SL passing reflex sight, 1 receiving reflex sight from SL, 2 putting ammunition in containers, 3 loading clips, 4 checking water in radiators).*

1 removes elevation reflex sight and reflector plate, receives azimuth reflex sight and reflector plate from SL; stows them in box; traverses, elevates, and depresses guns for cleaning and locking; locks guns in traveling position; acts as lookout during march order drill.



- 2** assisted by **3** and **SL**, cleans right gun; installs muzzle covers on guns; stows equipment; loads empty clips, refills all ammunition containers around mount from supply in trailer or stowage compartment; reports amount of ammunition to **SL**.
- 3** assisted by **2** and **SL**, cleans left gun; replaces automatic loader cover; stows equipment; loads empty clips; assists **2** in refilling ammunition containers around mount; counts ammunition in storage compartment and trailer; reports amount of ammunition to **SL**.
- 4** inspects carriage and engines; reports oil, fuel, and water supply to **SL**; inspects area adjacent to vehicle to determine the best method for moving vehicle out; reports to **SL** when vehicle is ready to move out.

## **74. CONNECT TRAILER.**

**SL** commands: **CONNECT TRAILER.**

**4** drives vehicle into position to connect trailer.  
**SL, 1, 2, and 3** dismount.

**SL, 1, 2, and 3** lift drawbar.

**SL** directs **4** in maneuvering vehicle and **1, 2, and 3** in maneuvering trailer to engage lunette eye; closes and locks pintle hook; connects safety chains; pulls out spring latch and locks parking wheel up; releases hand brake.

**SL, 1, 2, and 3** mount vehicle.

**SL** notifies section leader when squad is ready to move out.

## CHAPTER 5

### PREVENTIVE MAINTENANCE TASK TABLES

---

**75. PURPOSE.** **a.** Preventive maintenance task tables are a means of assigning periodic maintenance tasks to specific individuals of the crew and of insuring that complete preventive maintenance is accomplished regularly and systematically.

**b.** The tasks as outlined are intended as a *guide* for preventive maintenance to be performed by the members of the squad under the supervision and responsibility of the squad leader at the direction of the battery commander.

**c.** The tables include both operational and maintenance checks since both serve the primary function of keeping the equipment in proper operating condition.

**76. INSTRUCTIONS.** **a.** Paragraphs 79 through 84 indicate the duties of the various squad members in the performance of before operation, during operation, at-halt, after operation, daily, and weekly maintenance of the twin 40-mm gun motor carriage and trailer. Some of the checks outlined in the daily check list must be performed at frequent intervals during the day.

**b.** When a member of the squad is absent, his duties are accomplished by the individual replac-

ing him. When there is no replacement available, the squad leader is responsible that the absentee's maintenance duties are performed. It is desirable to rotate maintenance duties to acquaint as many men as possible with the duties of the other crew members.

**c.** The section leader, platoon commander, and battery commander should inspect the performance of maintenance at *frequent regular intervals*.

**d.** The abbreviations used in paragraph 86 are as follows: A, adjust; C, clean; I, inspect; L, lubricate; Te, test; R, replace when unserviceable; and T, tighten.

**77. TASK TABLES.** **a.** The duties of each member of the squad in paragraphs 79 through 84 should be expanded locally in the form of maintenance task tables. An example of such a maintenance task table for the gun pointer is given in paragraph 86.

**b.** Figures 36 and 37 illustrate check sheets which may be prepared locally. Each member of the squad initials the check sheet after completion of his periodic maintenance duties, thus providing a record of the preventive maintenance accomplished.

**78. REFERENCES.** Detailed maintenance instructions are contained in—

TM 9-252	40-mm AA gun Matériel.
TM 9-757	Twin 40-mm Gun Motor Carriage M19.
TM 9-883	1-Ton, 2-Wheel Cargo and Water Trailers.

WDLO 9-U556 Sight, Computing, M13.  
 WDLO 9-757 Carriage, Motor, Twin 40-mm,  
 Gun, M19.  
 SNL A-50 Gun, Automatic, Dual, 40-mm,  
 M2; and Mount Combination  
 gun, M4.  
 SNL G-200 Carriage, Motor, Twin 40-mm  
 Gun, M19.  
 SNL F-315 System, Local Control M16.  
 SNL F-316 Sight, Computing, M13.

## **79. BEFORE OPERATION CHECKS AND MAINTENANCE.**

SL *inspects* trailer lamps and reflectors, wheel nuts, tires, fenders, towing connections, body, tarps, and load.

- 4 *inspects* fire extinguishers, accessories, and drives, for leaks, engine operation, warning signals, tachometers, engine temperature gages, ammeter, siren, lights and reflectors, wheel and flange nuts, tracks, springs, suspensions, steering brake linkage, fenders, towing connections, decontaminator, and tools and equipment. *Inspects and adds (if needed)* fuel, oil, and water.

## **80. DURING OPERATION CHECKS AND MAINTENANCE.**

SL *observes* trailer for shifting of load or abnormal performance.

- 4 *inspects* steering brakes, transmissions, transfer unit, engines and controls, instruments, and running gear.

## 81. AT-HALT CHECKS AND MAINTENANCE.

**SL** *inspects (trailer)* springs and suspension, temperature of hubs and brake drums, wheel nuts, tires, fenders, body, load, tarp, and towing connections

- 4 *inspects* temperature of hubs, transfer unit, differential, and final drives; propeller shafts; suspension, steering brakes; wheel and flange nuts; tires and tracks; for leaks; air cleaners; fenders; and towing connections. *Inspects and adds (if needed)* fuel, oil, and water. *Inspects and cleans* glass and vision devices.

## 82. AFTER OPERATION CHECKS AND MAINTENANCE.

**SL** *inspects (trailer)* electrical wiring, tires, springs and suspension, fenders, towing connections, body, load, and tarp. *Inspects and cleans* lamps and reflectors. *Tightens* wheel, rim, and spring U-bolt nuts.

- 4 *inspects* engine operation, instruments, siren, fire extinguishers, decontaminator, batteries, accessories and belts, electrical wiring, engine controls, tracks, suspension, steering brakes, propeller shafts, for leaks, fenders, and towing connections. *Inspects and adds (if needed)* engine fuel, oil, and water; oil level of transmissions, transfer unit, and final drive housings. *Inspects and cleans* all glass; lights; air cleaners, breathers, and vents; and vision devices. *Cleans* driving

compartment. *Lubricates* vehicle as required by War Department Lubrication Order.

### **83. DAILY CHECKS AND MAINTENANCE.**

**SL** *inspects* oil gear hydraulic oil level, interphone equipment, azimuth switch. *Inspects and adjusts* boresighting and orientation, and reflex sight mounts. *Exercises* computing sight. *Inspects and cleans* reflex sight and reflector plate, external surface of sight. *Inspects, adjusts, and adds recoil fluid (if needed)* to recoil cylinders. *Inspects and replaces (if unserviceable)* desiccators on inverter, distribution box, and oil gears. *Lubricates* sight as required by War Department Lubrication Order. *Supervises* work of squad members in performing maintenance tasks. *Spot checks* maintenance performed by squad members. *Reports* any deficiencies not corrected to section leader. *Performs* before operation checks in paragraph 79 on trailer if not already performed that day.

**1** *inspects* power operation of mount laterally and vertically, elevation traveling lock, azimuth traveling lock, manual elevating mechanism, adjustment of equilibrators, elevation switch lever, firing triggers, foot firing pedal, and interphone equipment. *Inspects and cleans* distribution box assembly. *Inspects, cleans, and adjusts* elevation reflex sight and reflector plate. *Inspects and adjusts* oil gear hydraulic elevation cam limit.

*Lubricates* mount as required by War Department Lubrication Order.

- 2 *inspects* on the right gun recoil indicator pointer, gun breech casing and operating covers, cartridge case deflector, manual traversing mechanism, automatic loader, automatic loader feed control thumb lever, automatic loading tray including rammer shoe, and firing mechanism. *Inspects and cleans* external surfaces on right gun and right half of mount, ammunition and clips. *Inspects, cleans, and lubricates* barrel. *Inspects, cleans, and replaces (if unserviceable)* breechblock and components, extractor and components, and breech ring closing spring and components. *Lubricates* right gun as required by War Department Lubrication Order.
- 3 *inspects* on left gun, recoil indicator pointer, gun breech casing and operating covers, cartridge case deflector, automatic loader, automatic loader feed control thumb lever, automatic loading tray including rammer shoe, and firing mechanism. *Inspects and cleans* external surfaces of left gun and left half of mount, ammunition and clips. *Inspects, cleans, and lubricates* barrel. *Inspects, cleans, and replaces (if unserviceable)* breechblock and components, extractor and components, and breech ring closing spring and components. *Lubricates* left gun as required by War Department Lubrication Order.
- 4 *inspects* interphone equipment. *Cleans* external surfaces of vehicle. *Lubricates vehicle*

as required by War Department Lubrication Order. *Performs* before operation checks in paragraph 79 if not already performed that day.

#### 84. WEEKLY CHECKS AND MAINTENANCE.

**SL** *inspects* sight elevation eccentrics, and alinement of guns. *Inspects, cleans, and replaces (if unserviceable)* recoil cylinders (complete assembly), and lighting system of azimuth reflex sight. *Inspects and adjusts* parallel linkage. *Replaces (if unserviceable)* screws, nuts, pins, and studs on computing sight; flexible shafts; reflex sights, reflector plates, or open ring sights; and trailer tires. *Tightens* loose nuts and bolts, and towing connection assembly and mounting bolts of trailer. *Lubricates* sight as required by War Department Lubrication Order. *Runs* following tests on computing sight: zero speed deflection check, vertical and lateral backlash check, over-all operation check, superelevation check, and parallel connecting rod backlash check.

**1** *inspects, clean, and replaces (if unserviceable)* lighting system elevation reflex sight. *Tests* equilibrators and oil gear operation. *Lubricates* mount as required by War Department Lubrication Order. *Tightens* gun mounting attachments, tools, and equipment mounted on vehicle.

**2** *inspects, cleans, and replaces (if unserviceable)* on right gun barrel assembly, breech



ring and components, cartridge rammer shoe and components, automatic loader complete assembly. *Lubricates* right gun as required by War Department Lubrication Order.

3 *inspects, cleans, and replaces (if unserviceable)* on left gun barrel assembly, breech ring and components, cartridge rammer shoe and components, automatic loader complete assembly. *Lubricates* left gun and trailer as required by War Department Lubrication Order. *Cleans* trailer.

4 *inspects* battery water and *adds (if needed)*. *Inspects and tightens* tracks and suspension. *Cleans* external surfaces of vehicle, stowage compartment, and all tools and equipment. *Lubricates* vehicle as required by War Department Lubrication Order.

**85. OTHER MAINTENANCE.** Other checks, lubrication, and maintenance accomplished on a mileage basis or at time intervals greater than weekly are performed as prescribed in the appropriate War Department Technical Manuals and War Department Lubrication Orders.

**86. MAINTENANCE TASK TABLE.** An example of how the items in paragraphs 79 through 84 can be expanded locally for convenient use is as follows:

### MAINTENANCE TASK TABLE

#### No. 1, GUN POINTER

#### TWIN 40-MM GUN MOTOR CARRIAGE M19 AND ASSOCIATED EQUIPMENT

Daily		
Task No.	Item	Operations
1	Power operation of mount laterally and vertically	I
2	Elevation traveling lock	I
3	Azimuth traveling lock	I
4	Manual elevating mechanism	I
5	Adjustment of equilibrators	I
6	Elevation switch	I
7	Firing triggers	I
8	Foot firing pedal	I
9	Interphone equipment	I
10	Distribution box assembly	IC
11	Elevation reflex sight and reflector plate	ICA
12	Oil gear hydraulic cam limit	IA
13	Lubricate mount as required by War Department Lubrication Order	L

Weekly		
Task No.	Item	Operations
1	Lighting system, elevation reflex sight	ICR
2	Equilibrators	Te
3	Oil gear operation	Te
4	Lubricate mount as required by War Department Lubrication Order	L
5	Gun mounting attachments	T
6	Tools and equipment mounted on vehicle	T

DAILY MAINTENANCE CHECK SHEET						
FOR _____, 19____						
DATE	INITIALS OF CREW MEMBERS					INSP. OFF. INITIAL
	SL	1	2	3	4	
1	C.H.	P.O.				
2	C.H.	L.O.				
3						
4						
5						
6						
7						
8						
28						
29						
30						
31						

NOTE: Crew members initial in appropriate square upon completion of daily maintenance duties.

NOTE: Any maintenance not completed or any repairs needed are to be reported immediately to the S L.

Figure 36. Daily maintenance check sheet.

WEEKLY MAINTENANCE CHECK SHEET						
FOR _____, 19____						
DATE	INITIALS OF CREW MEMBERS					INSP. OFF. INITIAL
	SL	1	2	3	4	
1	<i>C.H. 1-5</i>	<i>L.O.</i>	<i>J.T.</i>	<i>U.B.M.</i>	<i>F.H.</i>	
2	<i>C.H. 6-12</i>					
3						<i>S.O.R.</i>
4						
5						
6						
7						
8	<i>C.H.</i>	<i>L.O.</i>	<i>J.T.</i>	<i>U.B.M.</i>	<i>F.H.</i>	
28						<i>A.P.</i>
29	<i>C.H.</i>	<i>L.O.</i>	<i>J.T.</i>	<i>U.B.M.</i>	<i>F.H.</i>	
30						
31						

NOTE: Any maintenance not completed or any repairs needed are to be reported immediately to the S L.

NOTE: SL prescribes the dates on which weekly maintenance is to be performed.

Figure 37. Weekly maintenance check sheet.

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